Field Strength Meter

Multimetter FSM 450

User Manual

Televés

www.televes.com

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SAFETY MEASURES

Before using the equipment, read the user manual and read the section on SAFETY MEASURES.

The symbol on the equipment indicates: “SEE USER MANUAL”.

This manual may also contain the Caution or Warning symbols.

CAUTION AND WARNING messages may appear in this manual in order to avoid the risk of accidents or to avoid causing damage to the equipment or to other property.

1.- INSTALLATION

1.1.- SAFETY MEASURES

- **The non-specified use of the equipment** does not ensure its safety.
- The external DC adapter is **class I** equipment, so for safety reasons it should be connected to **a supply line with the corresponding ground terminal**.
- This equipment can be used in installations with **Overvoltage Category II** and in environments with **Pollution Degree 2**.
- When using any of the following accessories, it is necessary to use only those types **specified** for reasons of safety:
  Rechargeable battery
  External DC adapter
- Always take the **specified margins** into account both for the power supply as well as for the measurements.
- Remember that any voltages above **60 V DC** or **30 V AC** rms are potentially dangerous.
- Always check the **specified maximum environmental conditions** for this equipment.
- The user is only **authorised to:**
  Replace the batteries.
  The Maintenance section provides specific instructions for this type of service.
  Any other modification in the equipment should be carried out by specialised personnel only.
- The negative of measurement is at ground potential.
- **Do not obstruct the equipment’s ventilation system**.
- Use the appropriate cables with low radiation levels (for example, Televés’ T100) for the signal inputs/outputs, especially when using high levels.
- Follow the **cleaning instructions** described in the Maintenance section.

1.2.- POWER SUPPLY

The **FSM 450** has two operation modes; external powering or battery powered.

1.2.1.- External powering

A DC adapter is provided with the equipment which allows you to connect the equipment to the mains, both for normal operation as well as for charging the batteries. There is a special compartment for it in the cover. To connect the equipment to the mains, connect the adapter to the power connector (31) located on the side of the equipment (see 2.2.- *Element description*).

When the equipment is connected to the mains, the **Ext. Sup. LED** (11) lights up (see 2.2.- *Element description*).

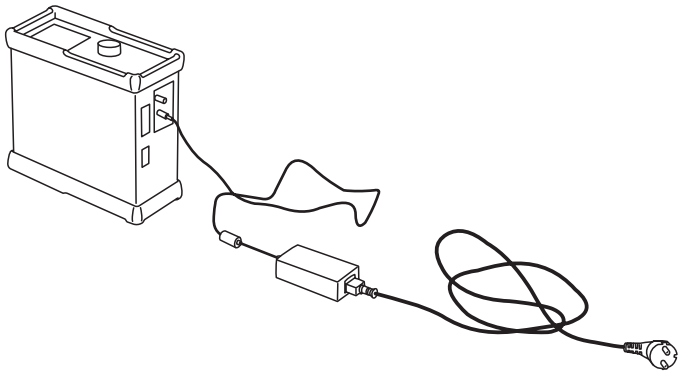


Figure 1.- Connection to the mains

1.2.2.- Battery powered

The **FSM 450** comes with one 12V Ni-MH battery. This battery, using an average consumption, can power the equipment for more than two hours.

The equipment features a complicated control system for charging and discharging the batteries which optimises their duration and life, and this in turn means that the equipment can use this form of powering without any abrupt decrease in the length of time.

To charge the batteries, connect the equipment to the mains using the DC adapter (see previous section). If the batteries have less than 40% of their optimal power, the recharging process will begin automatically.

However, the battery can be charged even if it has more than 40% of its optimal power by simply plugging the equipment into the mains and pressing the button for 3 seconds. To stop charging, press the same button again for 3 seconds.

While the equipment is charging the battery, the **Battery** (11) LED will flash.

In any case, the equipment will stop charging once this is complete.

The equipment is constantly monitoring the status of the batteries and it informs the user of their status via an LED icon (**Battery** (11)) and an audio signal.

The icon is a battery with a blue outline. When the batteries are fully charged, the inside part of the battery icon is completely yellow. As the battery discharges, the level of the yellow colour drops leaving the rest of the battery icon empty (transparent). The icon has 5 different levels, which represent the approximate status of the battery:

- Batteries charged <20% (icon totally empty)
- Batteries charged between 20 and 40%
- Batteries charged between 40 and 60%
- Batteries charged between 60 and 80%
- Batteries charged >80% (icon totally full)

The LED indicates the state of the batteries during the recharging process: when the equipment is connected to the mains, if the batteries are more than 40% full, they will not get charged (unless the recharging process is forced).

If the batteries are less than 40% full, the recharging process will begin. When the batteries are <20% full, the LED will light up for 500 msecs and will switch off for 2.5 secs. As they get recharged, the time that the LED is on will increase and the time that it is off will decrease. When the batteries are 80% full, the LED will light up for 2.5 secs and will switch off for 500 msecs. When they are completely full, the LED will remain on until the equipment is used.

Note: *If the temperature is too high, the charging process will not begin, and if this process is already underway, when the temperature reaches a certain level, the process will stop and will start again once the temperature has returned to an appropriate level*

When the external powering is disconnected, the LED will turn itself off.

If the batteries get below a certain level, the equipment will begin to make a buzzing noise and a message will appear onscreen indicating a low battery. If the battery level continues to drop, the equipment will indicate this every 10 seconds, warning you that it will shut down unless you connect it to the external powering before 30 seconds have passed. If this is not carried out, the equipment will shut down.

On the equipment's information screen (see 3.3.2.6.- *Information about the equipment*) you can also see information about the voltage of the batteries.

Note: *When the battery has run out completely, the recharging process will take about 7 hours if the equipment is switched off during the entire process. If the equipment is on, the same process will take about 14 hours*.

Note on charging the battery:

⇒ Whenever possible, it is advisable to recharge the batteries completely. In other words, when the recharging process begins, do not interrupt it, until the batteries are 100% full.

⇒ If you are not going to use the equipment for a while, the battery level should not be very low. The batteries will discharge slowly while the equipment is not in use, therefore it is advisable to carry out a recharging process every 2 or 3 months if the batteries are stored in a room temperature of 25ºC. The higher the room temperature, the more frequent the recharging process.

⇒ The batteries should be recharged when they are inside the meter and using the DC adapter that is provided with the equipment or by providing a current within the specified range (12 - 14,8 V). This is the only way to ensure that the batteries have a long life.

⇒ For the batteries to work properly, it is necessary to charge and discharge the batteries completely various times.

1.3.- START-UP

The equipment has a battery already inside, so to switch the equipment on, press the ON button (10). You do not need to connect the equipment to the mains. Once this button has been pressed, all of the LEDs will light up for a few seconds. During this time, the Televés logo will appear onscreen as will the equipment's software version.

Once a few seconds have passed, all the LEDs will switch off, except the ON LED.

If the equipment is connected to the mains, the **Ext. Sup.** (green) LED will also stay on. If the batteries are less than 40% full, these will begin to recharge and the **Battery** LED (green) will light up as can be seen in the previous section.

2.- PRODUCT DESCRIPTION

The **FSM 450** is a portable meter with a 5" coloured screen which features all of the basic functions that are necessary to guarantee a high level of quality in an analogue or digital RTV installation.

The meter's robustness and the fact that it is easy to use together with the long duration of battery life (more than two hours with a combined average consumption) make it an excellent portable device.

It has been designed to carry out measurements both in analogue channels (level, C/N, V/A), as well as in digital channels (power, C/N, BER, MER, MPEG), and both in the terrestrial band (47-860 MHz) as well as in the satellite band (950-2150 MHz).

It incorporates the **MPEG demodulation** function in **COFDM**, **QAM** and **QPSK** of free channels.

By means of some new functions, you will be able to create up to **100 memories** of your most commonly used measurements, and make them automatic via the execution of Macromeasurements. The results will be displayed in up to **100 different DATA LOGS with hundreds of different outlets and each one of these with tens of measurements.** These measurements can then be downloaded onto the PC thanks to the included **DataLogger** program (FSM Management).

The menu functions are in a hierarchic order, so that they are very easy to find and use.

Another important characteristic is that the menu functions are displayed on the 5" coloured TFT screen. Thanks to the OSD function, we can see the images of the tuned channel (or the spectrum), the menu functions and other information windows onscreen, as can be seen in the following figures:

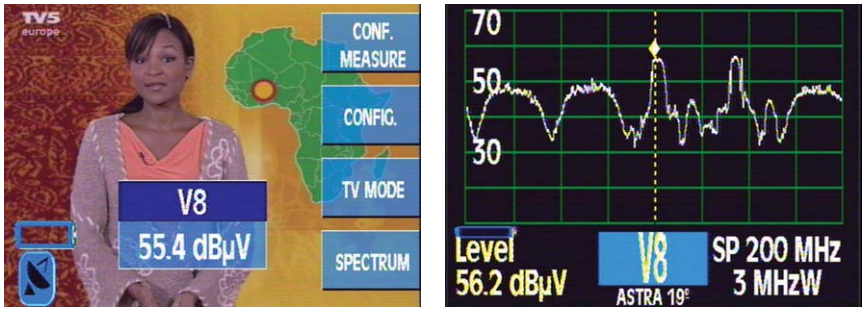


Figure 2.- TV mode or spectrum

To the right of the screen, you can see the buttons that are used to access the function or submenu that is being indicated at that moment on the screen.

2.1.- SPECIFICATIONS

Next, you can see a list of the main specifications of the **FSM 450**.

Monitor:

Screen TFT 5" colour

Standard Multistandard: PAL (B, G, D, K, I), SECAM (B, G, D, K, L)

Synchronism burst Onscreen presentation via the OSD function

Synchronism 50 Hz

Video signal

- **External video input**: SCART (on, off and auto)
- **Sensibility**: 1Vpp (75 ohm) positive video
- **Video output**: SCART (composite video)

Sound

- **Input** SCART
- **Outputs** SCART and built-in loudspeaker
- **Demodulation** AM
- **De-emphasis** 50µs/75µs
- **Subcarrier** Variable from 4 to 9 MHz with a 10 KHz resolution both for terrestrial as well as for satellite signals.

  Terrestrial: according to the selected standard:

Standard	PAL B/G	PAL D/K	Pal I	SECAM B/G	SECAM L	SECAM D/K
Subcarrier	5.50 & 5.74	6.50 & 6.74	6.00	5.50 & 5.74	6.50 & 5.85	6.50 & 5.85

  Satellite: 7.02 and 7.20 MHz, regardless of the standard

Mechanical specifications:

Anti-shock protective holsters

Weight: 5 Kgs (without bag).

Size: 280 x 130 x 310 (protective holsters includes)

External units and batteries:

Powering of external units: Via the RF connector

Powering of the preamplifiers and LNB: Voltage (12/17/24 V) and 22 KHz tone (on and off)

Batteries: 1 battery Ni-MH 12V and 3,5 Ah.

Automatic shut down: Programmable after a period of inactivity from between 1 and 59 min. (15 min by default)

Battery status: An LED, an onscreen icon and a buzzing noise indicating a low battery.

External powering connection: Via a DC adapter provided with the FSM.

External powering: 12 - 14,8V

Maximum consumption: 35W

Batteries recharged using provided adapter for car lighter

Measurements:

Measurement units: dBµV

Numerical indication onscreen using the OSD function

Frequency range: Terrestrial band: 47-860 MHz

Satellite band: 950-2150 MHz

Frequency resolution: 50 KHz terrestrial and 100 KHz satellite

Resolution level: 0,1 dB

Typical precision: ± 1 dB terrestrial and ± 2 dB satellite

Reading and compensation: Automatic

Dynamic range: Greater than 50 dB

Analogue: Level (numerical indication, bar and audio signal), C/N, V/A representation of the synchronism burst

Digital: Channel power, C/N, BER (COFDM, QAM, QPSK), MPEG (CODFM, QAM, QPSK), MER (COFDM, QAM, QPSK).

Level measurement:

Measurement margin:

Terrestrial bands and FM: 15 dBµV to 130 dBµV

Satellite band: 20 dBµV to 120 dBµV

Measurement bandwidth: 250 KHz (terrestrial band) and 3 MHz (satellite band)

Spectrum representation:

Resolution filters: 100 KHz, 250 KHz, 1 MHz and 3 MHz automatically

Horizontal span: Terrestrial band: selectable (8, 16, 32, 48, 96, 192, 496 MHz) and Full Span

Satellite band: selectable (25, 50, 100, 200, 512 MHz) and Full Span

Reference level: Terrestrial band: selectable from 60 and 130 in steps of 10

Satellite band: selectable from 60 and 120 in steps of 10

Attenuator: Automatic

Environmental working conditions:

Height: Up to 2000 m

Temperature margin: From 0 to 40 º C

Maximum relative humidity: 80 % (Up to 31ºC), in a linear decrease until 50% at 40º C.

Accessories included:

1 - CD software (FSM Management)
1 - Cable series RS-232
2 - Adapter “F” female / ”F” female (139053)
2 - Push on adapter “F” male / ”F” female (140130)
1 - Adapter “F” female / ”CEI” male (140540)
1 - Adapter “F” female / ”CEI” female (140541)
1 - Adapter “F” female / ”BNC” female (140592)
1 - DC block “F” (140023)
1 - Adapter DC 12V external
1 - Car lighter recharger 12V (140093)
1 - Protective case for travelling

2.2.- ELEMENT DESCRIPTION

The front panel features the following elements:

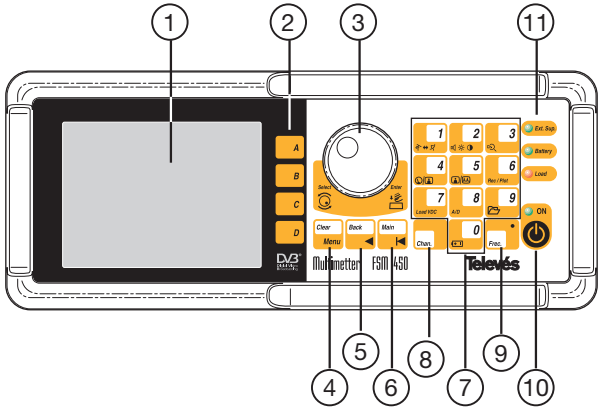


Figure 3.- Front panel

(1) Monitor

TFT 5" colour screen

(2) Short cut buttons

Each of these buttons correspond to one of the menu functions that can be seen onscreen at that moment.

(3) Rotating knob

Depending on where we are on the menu, there are two different functions. For example, if there is a parameter selection window open, it will allow us to change from one option to another and to select an option by ***pressing it*** Enter.

It can also be used to change channels (channel mode) o to tune another frequency (frequency mode).

In the following sections, when the meter's functions are explained in detail, the symbol will be used to indicate the parameters that are selected using the rotating knob.

(4) Clear/Menu

This makes the menu buttons appear and disappear from onscreen. It is also used to close the windows that appear in the middle of the screen (measurement windows, parameter selection windows, etc).

(5) Back

This button has two functions: if the user is entering some data using the number pad (frequency or password), then this button is used to erase the last digit entered, however in all other cases this button is used to return to the previous menu.

(6) Main

By pressing this button, the user returns to the main menu.

(7) Number pad and short cut buttons

The number pad allows us to enter the frequency that we want to tune. In the following sections, the symbol will be used to indicate the parameters that can be configured using the number pad.

Some of the buttons on the number pad are also short cut buttons to the most commonly used functions.

The following sections explain all of these functions in detail. The functions with a short cut button will have a picture of this button beside them.

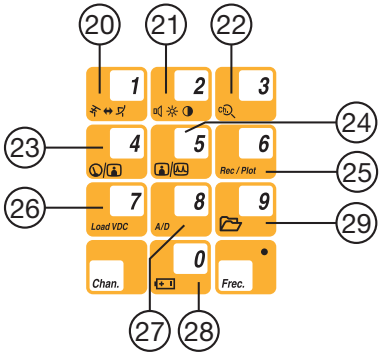


Figure 4.- Main keypad

(8) Chan

Selects the channel tuning mode. If there is a measurement window open, the tuned channel will be displayed in it. If there is no window open, the previous measurement window will be automatically opened.

(9) Freq

Selects the frequency tuning mode. If there is a measurement window open and the equipment was previously in the channel tuning mode, when you press the **Freq** button, the information regarding the tuned channel disappears and the video carrier frequency of that channel appears in its place. **Once the equipment is in frequency tuning mode, if we press this button again, the tuned frequency is erased and we can enter the frequency that we wish to tune using the number pad**. To enter the point which separates the decimal part of the value, we should press this button again. To confirm the frequency that we have just entered in the number pad, we should press the rotating knob

.

(10) ON

Starting-up button. To switch the equipment off, press this button for more that 2 seconds.

(11) Status LED´s

Ext. Supply: this indicates if the equipment is being powered externally.

Battery: this indicates if the batteries are being charged, and if this is the case, the battery level. While the batteries are being charged, the LED will flash.

Load: this indicates if the equipment is powering external elements. This is the only LED that is red so that it clearly warns the installer of this situation.

ON: this indicates if the equipment is switched on.

(20) Switching bands (Button1)

It immediately switches the frequency band from terrestrial to satellite and vice versa, both in TV mode and in spectrum mode.

(21) Access to the monitor parameters (Button 2)

This lets the user control the brightness, contrast, saturation and volume. Each time this button is pressed, the following parameter is selected.

(22) Channel search (Button 3)

This automatically tunes the next channel with a carrier level that is higher than the level selected by the user (see section *3.3.3.3.- Channel search*).

(23) Show / hide the previous measurement window (Button 4)

If there is a window of an analogue measurement open (V/A or C/N), when this button is pressed, it will close. And if we press it again, it will appear again, even if we are in another place in the menu. However, the level measurement is somewhat different. If the abbreviated level measurement window is open (this only displays information on the tuned channel or frequency and the measured signal level) and we press this button, the extended window will appear, which displays all the data of the abbreviated window as well as information on the standards, the audio carrier frequency etc.

(24) Switching analyser / TV viewing modes (Button 5)

This lets you change from the TV mode to the analyser mode and vice versa.

(25) Printing measurements (Button 8)

This automatically prints the measurement on an RS-232 printer.

(26) External powering (Button 7)

This opens the window that displays information on the powering of external units. These units are powered via an input F connector.

(27) Selecting analogue / digital measurements (Button 8)

This lets you change from the analogue to the digital measurements and vice versa. The menus are automatically located on the parts that correspond to the analogue or digital measurements. When the analogue measurements are selected, the level measurement window is opened, and when the digital measurements are selected, the power measurement window is opened and the picture onscreen disappears.

(28) Battery charging (Button 0)

By pressing this button for more than 3 seconds, the battery will begin recharging, whatever the battery level may be, as long as the meter is connected to the mains. The user can abort the recharging process by pressing this button again for more than 3 seconds.

Note: *If the temperature is too high, the charging process will not begin, and if this process is already underway, when the temperature reaches a certain level, the process will stop and will start again once the temperature has returned to an appropriate level*

(29) Memories Logger (Button 9)

This lets you directly access the Memory lists, the Macro Measurements and Data Logs.

Side view:

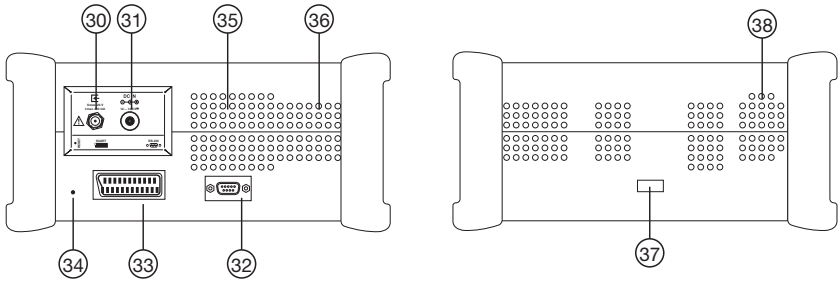


Figure 5.- The connectors on the side panels

(30) RF input

Input connector for the signal with an impedance of 75 ohm.

(31) Powering

Input for the external powering of 12 - 14,8 V⎓

(32) Serial port

Connection to the PC in order to use the FSM Management programme or for the upgrading of the meter's software.

Connection printer RS 232.

(33) SCART

(34) Reset button

When the user presses this button, it restarts the equipment. When you do this, the equipment retrieves the same configuration that it had when it was switched off propertly for the last time.

To reset the equipment, the user should use an object that is not sharp or particularly pointed, and gently press the button.

(35) Loudspeaker

(36) Ventilator

(37) Switch for configuration of batteries

(38) Ventilator

3.- HOW TO USE THE PRODUCT

3.1.- THE MENU

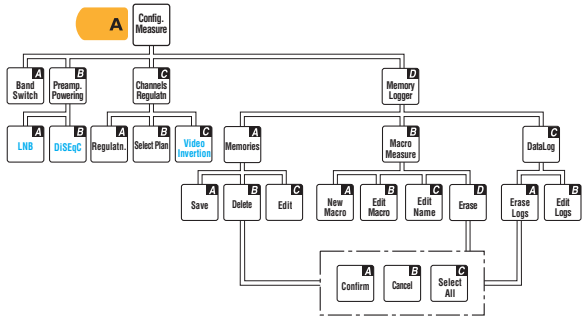
As explained previously, the different functions of the equipment have been placed in hierarchical order, so that they are very user-friendly.

The menu texts appear onscreen, superimposed over the picture, which can be the demodulated picture from the tuned TV channel (TV mode) or the spectrum (analyser mode). If in TV mode, the background of the text windows is slightly transparent so that it is still possible to see the picture. If we are looking at the spectrum, the menu texts are invisible by default, until the Clear Menu button is pressed or until one of the buttons A, B, C or D are pressed so that in this way, you can still see the spectrum properly.

If the equipment is in TV mode, when the user wants to change a parameter or see a measurement, once the corresponding function has been selected, a window opens onscreen with a transparent background.

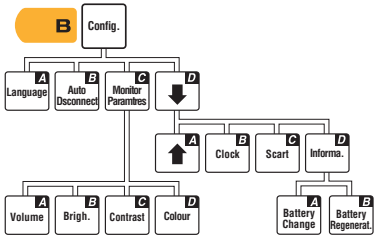
If however, the equipment is in analyser mode, the measurements appear on the lower part of the screen, so that the user can see the measurement and the spectrum at the same time.

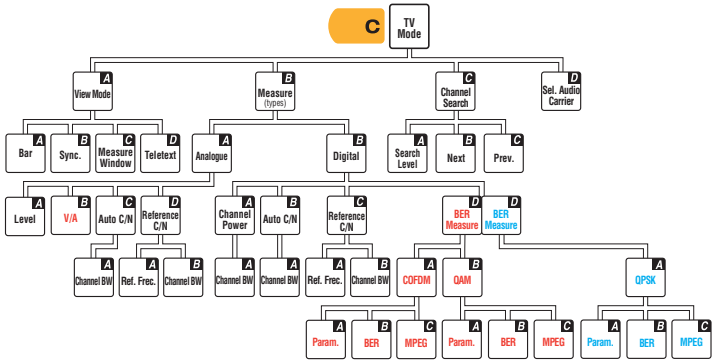
Here you can see a diagram which shows the equipment's functions in their hierarchical order:

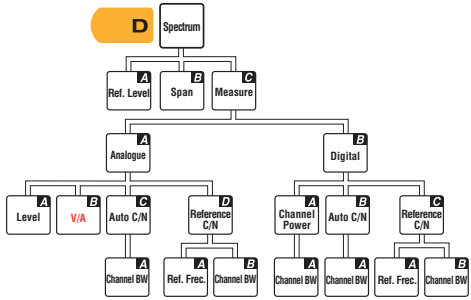


The functions with blue text are the measurements for the satellite band.

The functions with red text are the measurements for the terrestrial band.







The functions with blue text are the measurements for the satellite band.
The functions with red text are the measurements for the terrestrial band.

3.2.- TUNING MODES

The **FSM 450** has 2 tuning modes: by channel or by frequency. To select one or the other, use the **Chan.** (channel tuning) and **Freq.** (frequency tuning).

If using the channel tuning option, the measurements taken will be done on the video carrier of that channel. For example, if the selected plan is the CCIR, and the tuned channel is S01, the video carrier frequency is 105.25 MHz. Therefore, when the level is measured, the video carrier frequency level will be measured. If, for example, we want to measure the C/N, the equipment will automatically look for the video carrier frequency and carry out the measurement in this frequency. The same will happen with the V/A ratio measurement.

When a measurement window is open, and we press the **Chan.** button, we will go to the channel tuning mode, and we will see the tuned channel onscreen. If we turn the knob, the next channel will be automatically tuned and the new measurement will appear in the window.

On the other hand, if the frequency tuning mode has been selected, the measurements will be carried out in the frequency that is indicated. For example, if the C/N measurement is selected, the carrier level will be measured in the frequency selected by the user, which may not coincide with the video carrier of a channel. When a measurement window is open, and when we press the **Freq.** button we will go to the frequency tuning mode and the text with information about the frequency will be highlighted (dark background). In this way, we will be able to vary the frequency using the rotating knob (variations of 50 KHz in the terrestrial band and 100 KHz in the satellite band). If we press the **Freq.** button again, the information about the frequency will disappear and we will be able to enter the frequency using the number pad. To confirm the frequency press the rotating knob.

If the frequency tuning mode is selected and we press the **Chan.** button, we will access the channel tuning mode, and the window that is open at that moment will display the name of the channel that that frequency belongs to (according to the channel plan that is selected).

If the channel tuning mode is selected and we press the **Freq.** button, we will access the frequency tuning mode and the frequency that appears is the video carrier frequency of the channel that was tuned.

3.3.- FUNCTIONS

This sections explains all of the meter's functions in detail.

The main menu has the following options:

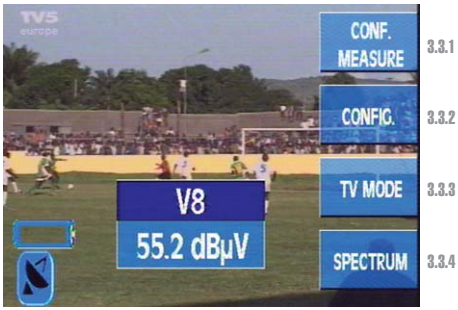


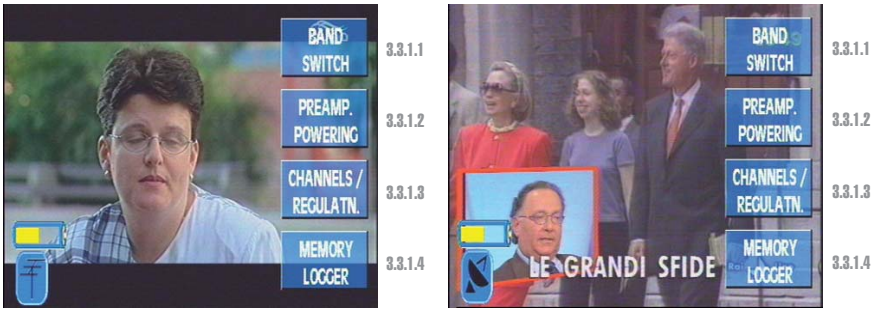
Figure 6.- Main menu option

3.3.1.- Measurement configuration

By using the functions in this menu you can set the parameters that affect the measurements that you are going to take.

All of the windows that are opened with the different functions of the “Measurement Configuration” menu can be closed by pressing the **Clear** button.

Within this option we have the following submenu:



Terrestrial band Satellite band

Figure 7.- Submenu options

3.3.1.1.- Band switching (short cut button 1)

This lets you switch bands from terrestrial to satellite and vice versa. When the band switching occurs, the icon at the bottom left-hand corner of the screen also changes at the same time. If the terrestrial band is selected, the icon that appears is an antenna for terrestrial signals , and if the satellite band is selected, the icon the appears is an antenna for satellite signals

3.3.1.2.- Preamplifiers (terrestrial band) **/ LNB and Preamplifiers** (satellite band). Short cut button 7 Load VDC :

It is acceded to the menu for the configuration the power to preamplifiers and LNB.

When turn ON the measurer, the option that appears selected will be always OFF.

This menu varies depending on which band is selected (terrestrial or satellite).

In the **terrestrial band**, a window will appear in which the installer can select the power and the tone of the preamplifiers:

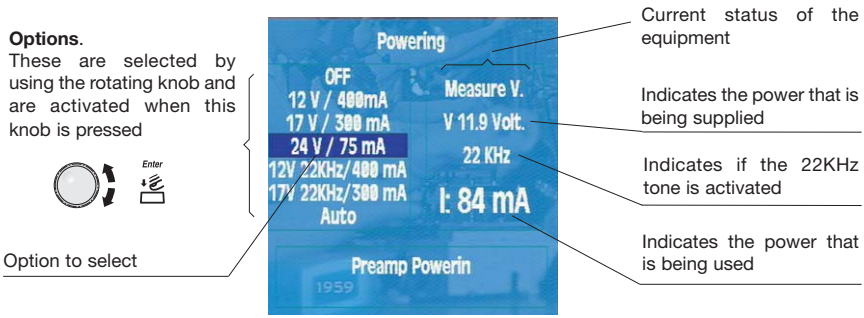


Figure 8.- Preamplifier powering

If the **satellite band** is selected, when the *preamplifier powering* option is pressed, the following submenu will appear:

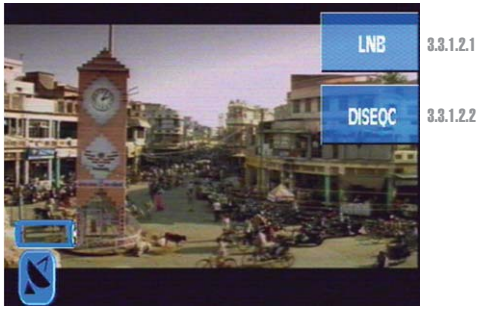


Figure 9.- Options available in the preamplifier powering submenu

It is worth noting that when a voltage is activated for the powering of an external device, the red led will light up (**Load**). If this led flashes, it is indicating that there is an error.

Also, the programming of the voltage depends on the band that is selected at the time, so that if 24V is selected in the terrestrial band, this does not mean that this voltage will pass to the satellite band.

3.3.1.2.1.- LNB (only satellite band):

When this function is selected, a window which is very similar to the previous one opens. The user can use this function to select the powering and tone of the LNB.

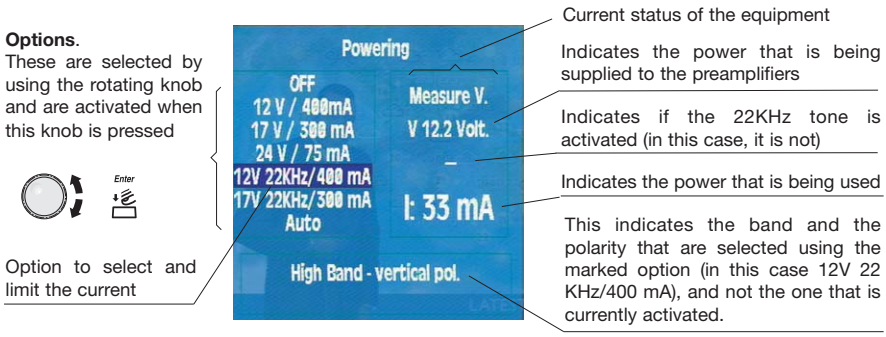

Options.
These are selected by using the rotating knob and are activated when this knob is pressed
Enter
Option to select and limit the current
Powering
OFF
12 V / 400mA
17 V / 300 mA
24 V / 75 mA
12V 22KHz/400 mA
17V 22KHz/300 mA
Auto
Measure V.
V 12.2 Volt.
I: 33 mA
High Band - vertical pol.
Current status of the equipment
Indicates the power that is being supplied to the preamplifiers
Indicates if the 22KHz tone is activated (in this case, it is not)
Indicates the power that is being used
This indicates the band and the polarity that are selected using the marked option (in this case 12V 22 KHz/400 mA), and not the one that is currently activated.

Figure 10.- LNB powering

If in the satelllite band, the band (high or low) and the polarity (vertical or horizontal) that correspond to the selected powering and tone appear on the lower part of the windows

12V / 400mA	==>	low band, vertical polarity
17V / 300mA	==>	low band, horizontal polarity
24V / 75mA	==>	preamplifier powering
12V 22KHz / 400mA	==>	high band, vertical polarity
17V 22KHz /300mA	==>	high band, horizontal polarity
Auto	==>	this is only useful in the satellite band. It sets the appropriate power and tone automatically, according to the selected channel table, (using a universal LNB) to select the band (high or low) and the polarity (vertical or horizontal) to tune the selected channel.

The equipment continuously monitors the current in the F connector, and warns the user of any error by means of a message window that appears on top of any other window that may be open. The possible problems which may arise related to the powering of the external units are as follows:

- The equipment detects a current in the coaxial cable. In this case, the message that appears as a warning is "**Vext**". This situation should be avoided.
- When the equipment detects a shortcircuit, it emits an audio signal and the message that appears as a warning in this case is "**Shortcircuit**".
- In the same way, the equipment warns the user when the consumption is greater than the maximum amount permitted. The message that appears is "**Exceeded limit**". In the last two cases, the power is cut-off and it automatically tries again approximately every 3 seconds.

3.3.1.2.2. DiSEqC (satellite band only):

The Diseqc protocol lets you work with multiswitches that have up to 16 inputs. To do so, when the meter is in the satellite band, you must enable, in the powering menu, the current and tone that corresponds to the desired polarity and satellite band. As well as the chosen band and polarity, it is necessary to specify the satellite that we are going to receive the signal from (the multiswitches organise the different polarities in groups of four, and identify each group using the names SAT A, SAT B, ...). To do so, the user must enter into the DiSEqC section in the "Measurement configuration" menu and also in the "LNB and preamplifiers" menu. The following window will appear:

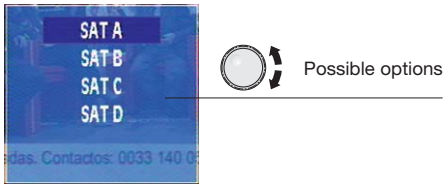


Figure 11.- Selecting the satellite in the multiswitch

The user must choose the appropriate satellite (a multiswitch with 8+1 inputs will only have satellite A and satellite B at its disposal).

Once this has been selected, press Enter. The equipment begins to send the command that informs the multiswitch about the chosen satellite, as well as the band and the polarity (which have been previously selected in LoadVDC).

When one of the DiSEqC inputs is chosen, if the powering of external units is off, an error message will appear.

When in satellite mode, using the short cut button 7 Load VDC it is possible to access simultaneously the LNB and DISEQC menus. We can choose the desired satellite using the buttons A, B, C or D.

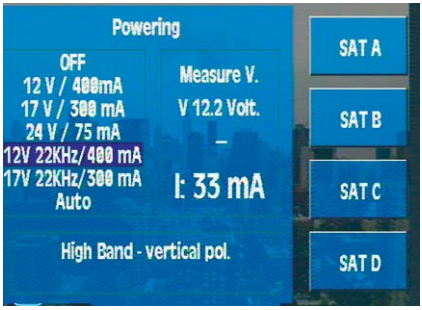


Figura 12.- Fast selection of the satellite

3.3.1.3.- Channels and Standards

3.3.1.3.1.- Standard

This allows you to select the colour standard. The standards that are available are as follows: **PAL B/G**, **PAL D/K**, **PAL I**, **SECAM B/G**, **SECAM L** and **SECAM D/K**.

The window that appears when this function is selected is as follows:

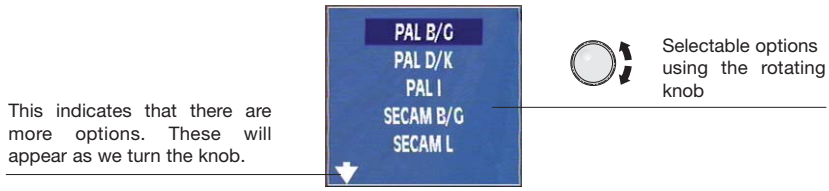

PAL B/G
PAL D/K
PAL I
SECAM B/G
SECAM L
Selectable options using the rotating knob
This indicates that there are more options. These will appear as we turn the knob.

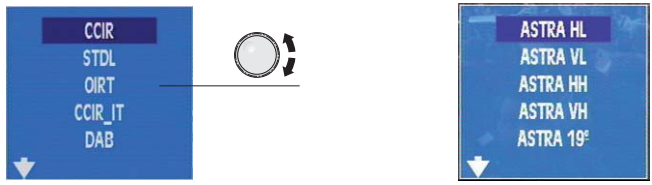
Figure 13.- Standard selection

3.3.1.3.2.- Select Plan

This selects the channel plan that the user wants to use. The options that will be available with this function will depend on the band that is selected:

Terrestrial band: CCIR, STDL, OIRT, CCIR-IT, DAB, SIM.4009

Satellite band: ASTRA 19 HL, ASTRA 19 VL, ASTRA 19 HH, ASTRA 19 VH, ASTRA 19, HOTBIRD HL, HOTBIRD VL, HOTBIRD HH, HOTBIRD VH, HOTBIRD, HISPASAT HL, HISPASAT VL, HISPASAT HH, HISPASAT VH, HISPASAT, DAB, SIM.4008, SIM.4009, ASTRA 28, EUROBIRD, NILESAT, ARABSAT, TURKSAT, EURASISAT, AMAZONAS, SIRIUS 5, THOR 1W.



Channel plans in the terrestrial band Channel plans in the satellite band

Figure 14.- Channel plans

Note: *The ASTRA 19, HOTBIRD, HISPASAT, plans include all the channels in both bands and both polarities, ordered according to their frequency. If the LNB needs to be powered, it is advisable to select the Auto option in the power supply menu for the preamplifiers and the LNB.*

3.3.1.3.3.- Video invertion

This function lets you select if the video signal that comes from a satellite band is inverted (**ON**) or not (**OFF**). By default, this option is OFF.

It is useful when watching the video of satellites from the C band.

Figure 15.- Video polarity selection

3.3.1.4.- Memory Logger.

This section describes how to access a series of functions that let you turn the majority of processes that you carry out with the meter into automatic operations.

On screen you will see a window with a list of the meter memories. If no memories have been recorded, the window will be empty.

Figure 16.- List of available memories

Using this menu, it is also possible to access the graph functions, however this will only happen when the meter is in analyser mode. If you do not dispose of the graph option, the menu key will appear with a shadow.

3.3.1.4.1.- Memories. Short cut button

:

The **FSM 450** lets you save up to **100 different configurations** (memories) for your equipment, which you will be able to retrieve very simply.

The measurer is able to store any state in which is as mode, norm, measurement type, etc.

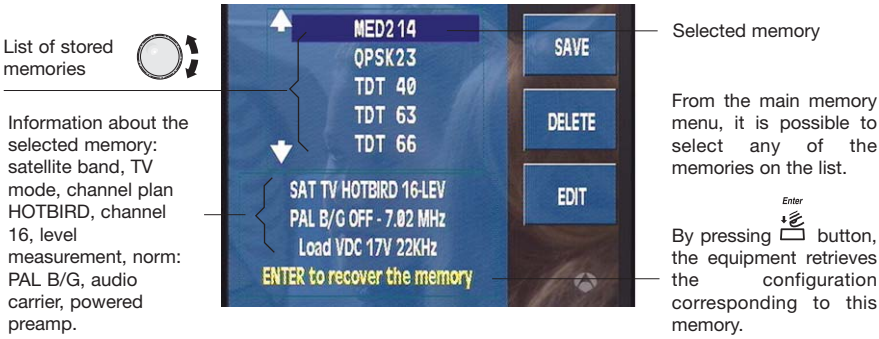

List of stored memories
Information about the selected memory: satellite band, TV mode, channel plan HOTBIRD, channel 16, level measurement, norm: PAL B/G, audio carrier, powered preamp.
MED2 14
QPSK23
TDT 40
TDT 63
TDT 66
SAT TV HOTBIRD 16-LEV
PAL B/G OFF - 7.02 MHz
Load VDC 17V 22KHz
ENTER to recover the memory
SAVE
DELETE
EDIT
Selected memory
From the main memory menu, it is possible to select any of the memories on the list.
Enter
By pressing button, the equipment retrieves the configuration corresponding to this memory.

Figura 17.- List of available memories

To configure the equipment according to the stored parameters in a specific menu, simply press the 9 button (or go to the CONF. MEASURE => MEMORIES LOGGER => MEMORIES menu), select the desired memory from the list and press Enter.

If there isn't any memory in the meter, the message "*NO MEMORIES*" will appear onscreen.

3.3.1.4.1.1.- Save

To save a specific memory, place the meter in the desired configuration and press 9. Use the A button to select the MEMORIES function. The menu from the previous figure will appear. Now press the **SAVE** button. The list of memories will be located at the end of this list and the name of the following free memory will flash on and off.

By default, the name of the memory that appears is always **MEM** followed by **two digits** ordered according to their values, but the user can name each memory as desired.

There are four options:

1.- Press Enter to accept the **name** that appears **by default**.

2.- If we want to **change** the **digits** only, we simply need to **press the desired numbers** on the number pad.

3.- If we want to **write over** a memory in the list, we need to use the rotating knob to reach the memory. Once here, we should press Enter.

4.- If we want to **change the name** of the memory, press the **EDIT** button.

First free memory. Flashing digits with the lower disposable number.
Press Enter to save.
TDT 66
TDT 67
TDT 68
MEM
Input Number
ENTER to confirm
SAVE
DELETE
EDIT
On the lower part of the window, the instructions that the user must follow to save the memory appear.

Figura 18.- Saving a memory

When the user confirms that s/he wants to save the memory, the message "*MEMORY SAVED*" will appear onscreen.

The **maximum number** of memories that the meter can store is **100**. If the memory capacity is full, the message "*MEMORY FULL*" will appear onscreen.

3.3.1.4.1.2.- Delete

When you want to delete a specific memory, press the **DELETE** button. Next a new window appears where you can see the list of the available memories.

Figura 19.- Deleting memories

Use the rotating knob to move through the list. When you find the memory you want to erase, press Enter, and this memory will be highlighted.

If you want to select all the memories in the meter, you can use the **SELECT ALL** option, so that all the memories are highlighted.

When you have finished selecting, press **CONFIRM.**

When the user confirms that s/he wants to erase a memory, the message "*MEMORY ERASED*" will appear onscreen.

3.3.1.4.1.3.- How to Edit a Name

This function enables the user to modify the name of any memory, whether it has been saved or whether it is a new memory that the user wishes to save.

If it is a memory that is already on the list, press the **EDIT** button and then, using the rotating knob, select the memory name that you want to modify. Press

to accept.

The first letter of the name will start flashing thereby indicating that this is the letter that is to be edited. By turing the rotating knob, the rest of the letters in the alphabet including the numbers from 0 to 9 will appear. The "_" indicates a blank space, in other words, once the memory name has been saved, it will be sustitued by a blank space. Once the letter that you want appears in the position desired, press

and begin the process again with the following letter in the name.

If you want to return to the previous letter, press the **Back** button.

The **name** of **each memory** should have **between 1 and 6 characters**. Once the 6 characters have been edited, the process has finished. If the proposed name does not have 6 characters, it will be necessary to fill in the remaining spaces with blanks ("_").

If re-naming a memory that already exists, and if the new name has less characters than the old name, the characters that you wish to erase should be replaced with "_" (in other words, blank spaces).

If you are editing a memory that you are saving, press **EDIT** when the name proposed by the equipment is flashing. From now on, the process will be as described in the previous paragraph.

If you are trying to save a memory with the name of another memory in the list, the equipment will warn you. You can confirm the action by pressing

(in this case, the old memory will be erased) or you can cancel the action. To do so, simply rotate the knob (the name will disappear and the process will begin again).

It is not possible to save a memory with a name consisting of blank spaces only. In this case, the meter will display a message indicating that the name is incorrect.

When the user confirms the modification of the name of a memory, the message "*MEMORY EDITED*" will appear onscreen.

3.3.1.4.2.- Macromeasurements

A MACROMEASUREMENT is a group of a specific number of memories (different measurements), that the meter will be able to execute automatically and add the results to a specific measurement LOG. You can configure **up to 100 different MACRO MEASUREMENTS!** (automatic measurements with different memories).

The meter can carry out measurements from a list of memories whenever necessary, and then let the user view the results on the meter, or let the user download these measurements to the PC.

Conceptually, the meter can create the register per LOG and at the same time, in groups of outlets.

A DATA LOG is the list of results (measurements) that are obtained when a MACROMEASUREMENT is executed automatically, once or various times (different outlets in the same installation). The meter stores, at the same time **up to 100 different DATA LOGS !**. The equipment proposes a default name to identify the LOG. This name consists of a name (LOG) and the macromeasurement that was used.

Each DATA LOG (depending on the number of DATA LOGS that we have) can store the results of hundreds of different outlets, each one with tens of measurements. For example:

No. DATA LOGS	No. of outlets/ DATA LOG	No. of Memories (measures) / outlet	No. of MEASURES
1	440	70	30800
2	303	50	30300
3	100	100	30000
5	110	54	29700
10	40	70	28000

To execute a Macromeasurement quickly press the short cut button

, then the option **MACROMEASUREMENTS**. The window will display a list of available Macromeasurements. If no Macromeasurement has been created (*see section 3.3.1.4.2.1.- New Macro*) the window will be empty. Use the rotating knob to highlight the one we want to execute. The content of each Macromeasurement is displayed at the bottom of the window.

If there is no macromeasurement saved in the meter, the message "*NO MACROS*" will appear onscreen.

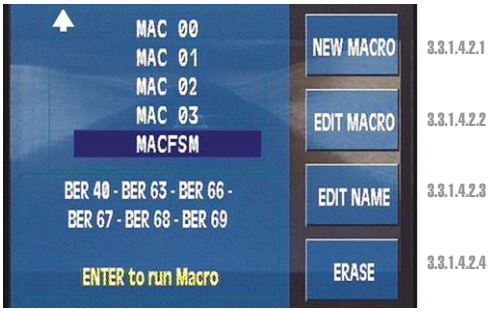


Figure 20.- Macromeasurements

When the Enter is pressed, the MACRO OPTIONS menu is displayed.

Figure 21.- Macro options

Use the rotating knob to choose the different options of this menu:

- Run Macro. Starts the execution of the selected Macromeasurement. If the selected macromeasurement does not contain any memory, the meter will display the following message "*MACRO EMPTY*".

Figure 22.- Execution of a Macro

- Outlet type. There are two choices, by default the **Filtered outlet** is used. The equipment establishes an execution order of the Macromeasurement. During the Macromeasurement and before carrying out the measurements that correspond to the satellite, the Meter will display a message warning that the connector of the separating outlet should be changed in order to continue executing the Macromeasurement.

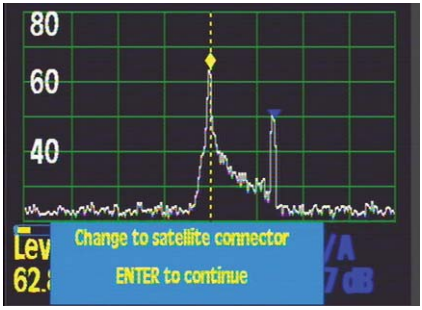


Figure 23.- Change to satellite connector

The other possibility that can be chosen using the Enter button is the **Broadband outlet** where the equipment carries out the Macromeasurement in both bands with no interruptions. If you press Enter a drop down menu will appear where you can choose an option using the rotating knob and accept your choice by pressing Enter.

During the executing process of a Macromeasurement a window will appear onscreen with information about the process. When the process is completed, the meter will make a warning noise and will propose a number for the outlet that was measured. This number will be the lowest avaible. The user can edit the name of the outlet by pressing the A button (CHANGE OUTLET N.).

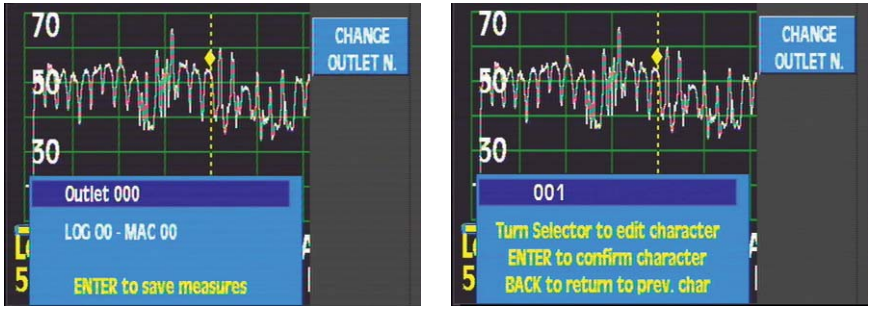


Figure 24.- Editing Outlet name

After naming the outlet, it can be saved by pressing the Enter button.

To execute the Macromeasurement again in a new outlet, press Enter again. If you want to finish the Macromeasurement, press any button.

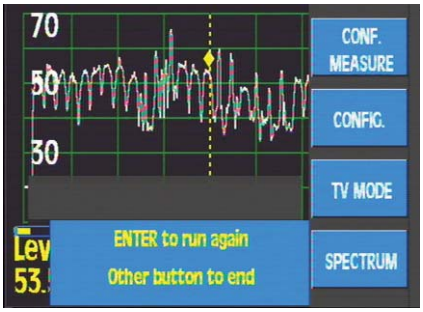


Figure 25.- Continue or cancel Macromeasurement

- LOG options. This option lets us select the possibility of continuing with a LOG which we had previously created or of starting with a new one, in this case the equipment will suggest a name for the new "LOG" register and will also suggest a two-digit number which will be the lowest available.

Figura 26.- LOG options

- Edit LOG name. This function lets the user modify the name of the new LOG.

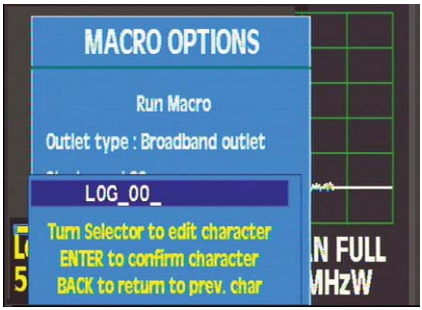


Figure 27.- Editing the LOG name

Note: *If we are executing a Macromeasurement, the function "Automatic shut-down" will be postponed until the end of this process.*

3.3.1.4.2.1.- New Macro

This option lets us create new Macromeasurements using the memories inside the meter.

A window opens and the name of a Macromeasurement appears with the cursor flashing. The name that the equipment proposes to identify each Macromeasurement is: “MAC” and a two-digit number which will be the lowest number available at that time. Using the function “3.3.1.4.2.3.- Edit Name” we can name the Macromeasurement as we like, so as to identify it more easily.

The **maximum number** of Macromeasurements that can be stored in the meter is **100**, if the user tries to save a new Macromeasurement, the message "*MACROS FULL*" will appear onscreen.

Figure 28.- Create new Macromeasurements

Press Enter to confirm, and then a list of the available memories appears.

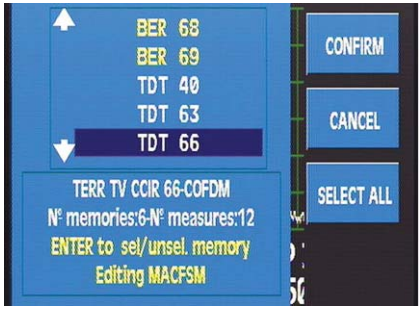


Figure 29.- Editing a Macro

We can use the rotating knob to move through the list. When we find the memory we are going to use, we should press Enter and the memory will be highlighted.

If we want to select all the meter’s memories, we can use the **SELECT ALL** option, so that all the memories are hightlighted.

At the bottom of the window, we will be able to see some important information about each memory that has been selected and the number of memories that we are putting into the Macromeasurement.

When we have finished the selection process, we must press **CONFIRM** and then

. The message "*MACRO SAVED*" will appear onscreen.

3.3.1.4.2.2.- Edit Macro

This option lets the user change the memories inside a Macromeasurement. It works in the same way as when creating a new Macromeasurement.

3.3.1.4.2.3.- Edit Name

This option lets you change the name of a Macromeasurement.

Once you have confirmed the change of name the message "*NAME CHANGED*" will appear onscreen.

3.3.1.4.2.4.- Erase Macro

We can erase a Macromeasurement when we think it is necessary using this option. It works in the same way as then erasing a memory.

Once the macro has been erased, the meter will inform you via the message "*MACRO ERASED*".

3.3.1.4.3.- View DATA LOGS

In this section you can see the results of the Macromeasurements that were executed.

The meter will display a window with a list of the DATA LOGS. At the bottom of the window you will see the content of each one.

The DATA LOGS are the measurements that the meter has saved when it has carried out any Macromeasurement.

The measurements of a MACROMEASUREMENT can be identified because they consist of two columns; the first identifies the name of the log with which it has been saved and the second column indicates the name of the macromeasurement.

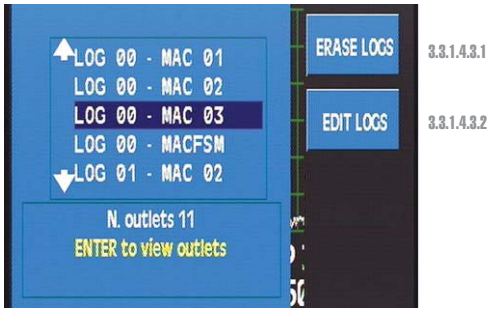


Figure 30.- List of DATA LOGS

If there aren't any DATALOGS stored in the meter's memory, the message "*NO DATALOGS*" will appear onscreen.

By pressing Enter a table with two columns will appear. On the left there are the outlets that have been measured and on the right there are the results of each outlet.

By turning the rotating knob, we can move through the different sockets of the LOG (left-hand column) and by pressing Enter we go to the column with the measurements of the socket that is highlighted (right-hand column). We can move through the different measurements of the socket in this column using the rotating knob. By pressing Back or Enter we return to the socket column.

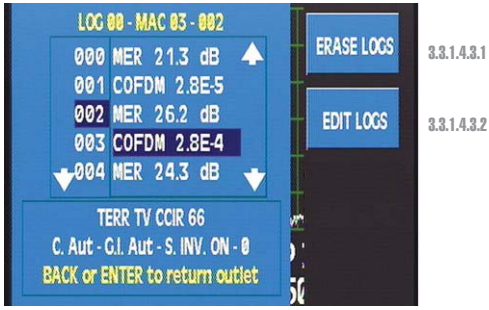

LOG 00 - MAC 03 - 002
000 MER 21.3 dB
001 COFDM 2.8E-5
002 MER 26.2 dB
003 COFDM 2.8E-4
004 MER 24.3 dB
TERR TV CCIR 66
C. Aut - G.I. Aut - S. INV. ON - 0
BACK or ENTER to return outlet
ERASE LOGS
EDIT LOGS
3.3.1.4.3.1
3.3.1.4.3.2

Figure 31.- Measurements in each outlet

3.3.1.4.3.1.- Erase LOGS

This option lets you erase the selected LOGS. To do this, use the rotating knob to mark the LOGS, selecting them using Enter. The marked registers will appear in yellow, then press the A button (CONFIRM) and complete the erasing process by pressing Enter. The message "*DATALOG ERASED*" will appear onscreen.

Note: *When you erase or edit a memory, it is also being erased or edited in the Macromeasurements where it appears. Erasing or editing a Macromeasurement does not affect the LOGs that have been generated with the erased or edited Macromeasurement.*

3.3.1.4.3.2.- Edit LOGS

This option lets us change the name of the desired LOG at any time. To do so, use the rotating knob to select the LOG, confirm your selection by pressing the Enter key. The name of this LOG will flash on and off and using the rotating knob and Enter button, we can change the characters.

3.3.2.- Equipment configuration

The functions in this menu set all of the parameters that are related to the meter's configuration.

All of the windows that open in the different functions in the "Equipment Configuration" menu can be closed by using the **Clear** button.

Within this option, there is also the following submenu (if we press the arrow below, the following options will appear, as can be seen in the second picture):

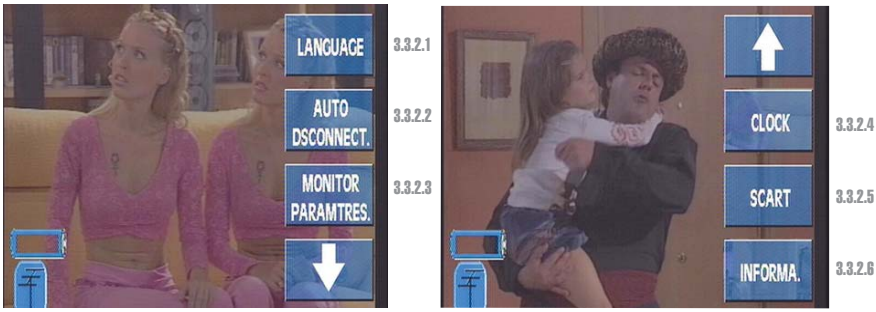


Figure 32.- Equipment configuration options

3.3.2.1.- Language

The **FSM 450** allows you to select the menu language. The languages that are available are: Spanish, English, Portuguese, French, German and Italian. The window that appears when this menu is selected looks as follows:

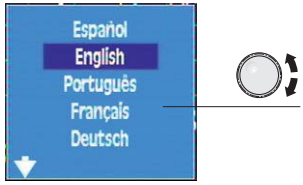


Figure 33.- Language selection for the menus

3.3.2.2.- Automatic shut-down

The equipment has the option of automatically turning off once a certain programmable time of inactivity has elapsed. This period of inactivity that can be selected ranges from 1 to 59 minutes. The user can also disable this function (OFF). The equipment has a default value for this period of inactivity of 15 minutes.

Figure 34.- Time left until shut-down

When the time programmed by the user has elapsed and the equipment has not been used, a message will appear onscreen "**Auto dsconnect**", together with an audio signal which will indicate that the equipment is about to shut-down. If no button is pressed, the message will appear 6 times and then the equipment will shut down.

Note: *Once the time that has been programmed by the user has passed, if a Macromeasurement is being carried out, the meter will wait until the end of this process before continuing with the disconnection.*

3.3.2.3.- Monitor

This menu consists of the functions that control the monitor's parameters: the volume, brightness, contrast and saturation. The window that appears when these functions are enabled is very similar in all cases. It consists of a horizontal bar. The length of this bar varies according to the level of the parameter that is selected. To change the value of these parameters, use the rotating knob and to close the windows use the **Clear** button.

Figure 35.- Monitor options

3.3.2.3.1.- Volume (short cut button 2)

Use the rotating knob to increase or decrease the volume. The volume screen appears as follows:

Figure 36.- Selection of volume

3.3.2.3.2.- Brightness (short cut button 2)

This increases or decreases the brightness of the picture onscreen. It operates in the same way as the volume control.

3.3.2.3.3.- Contrast (short cut button 2)

This increases or decreases the contrast of the picture onscreen. It operates in the same way as the volume control.

3.3.2.3.4.- Color (short cut button 2)

This increases or decreases the color of the picture onscreen. It operates in the same way as the volume control.

3.3.2.4.- Clock

The window that appears as follows:

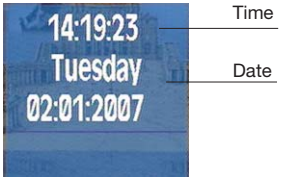


Figure 37.- Clock option

It is possible to vary the time (the hour and minutes) and the date (day, month and year). To do so, the user needs to press the rotating knob and the hour (in the time) will appear highlighted (dark blue square). If the user turns the knob the time will vary. When the knob is pressed again, the hour is confirmed and the minutes are hightlighted. If the knob is pressed for the third time, the day is highlighted, then the month and finally the year. To close the clock window press the **Clear** button.

3.3.2.5.- Scart

A window opens that allows you to select the control of the signals of the SCART:

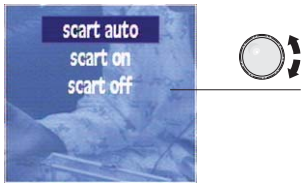


Figure 38.- Scart options

Scart auto: Normal operating mode of the scart, in other words, when there is a signal in the scart, it is automatically seen onscreen. It is important to note, however, that this function depends on the device being used, and therefore, it may be that, although a device with a video signal is connected to the scart, this may not appear onscreen. In this case, select the *Scart on* option. When the equipment is in *Scart auto* mode, and this detects a video signal in the scart, the antenna icon disappears from the screen (terrestrial or satellite) and instead, a television icon will appear: . The user therefore knows that the picture onscreen comes from the scart and not from the antenna.

Scart on: This forces the signal input from the scart connector. In this case, the television icon will always appear instead of the antennas, both when there is a signal from the scart and when there isn't.

Scart off: This disables the scart.

To close the window press the **Clear** button.

Notes:

- It is important to check the status of the scart mode selection, as if it is in *Scart on* mode, we will not be able to see the TV signal onscreen when we want to use the equipment in normal mode (input signal in the RF connector).
- If there is a signal in the scart, and if this is being seen onscreen (*auto* or *on*), the meter will carry on functioning normally as regards the measurements. In other words, the measurements that are carried out will correspond to the signal at the input of the "F" connector. It is not possible to take measurements of the scart signal. The same will happen with the spectrum representation of the signal, in other words, although the picture that we have onscreen will come from the scart, the spectrum will correspond to the RF input signal. **The only exception is the representation of the synchronism burst; this will indeed correspond to the synchronism of the scart's signal.**

- If the meter has a digital measurement window open (Power or C/N) it will be impossible to see the scart signal, although this may be in *auto* mode. **Therefore, if you wish to see the scart signal, make sure that the meter is not carrying out a digital measurement.**
- If you wish to see any TV signal onscreen, it is worth remembering that you can remove all the menus from the screen by using the **Clear/Menu** button, and the measurement windows by using the button or by accessing the Viewing Mode menu.

3.3.2.6.- Information about the equipment

When this function is selected, a window will open which will display information about the equipment, as can be seen below:

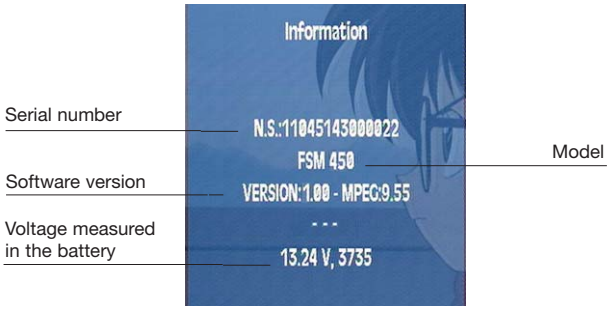


Figure 39.- Window displaying equipment information

3.3.2.6.1.- Changing the battery

When the installer wishes to change the batteries, it is necessary to inform the equipment so that it can modify the charging and discharging algorithm so as to optimize their lifespan and duration while in use.

Below is the process that must be followed when substituting the batterie:

1.- Substitute the battery by following the steps described in section 5.1.- Changing the battery.

2.- Select the **Changing the battery** function. Select the option Ni-MH 3,5 AH. A message will appear onscreen asking for confirmation of the change. To confirm the change, press the button.

If any other button is pressed, the change will be cancelled.

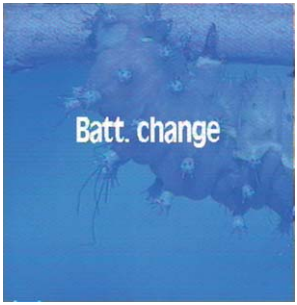


Figure 40.- Information window for changing the battery

Note: *This function must only be used when a battery change has really taken place, as it affects a series of parameters that are necessary for the control of the charging and usage of the batterie. If these vary, they will decrease the lifespan and the duration of the batteries.*

Warning about battery changing

- When removing or introducing the batterie, make sure that the meter is switched off.
- If you remove the battery, when you put it back in again, make sure that it is connected correctly.
- If you are using metal tools for the installation of the batteries, you must isolate them, as they could cause a shortcircuit.

- Do not connect the positive terminal to the negative terminal of a battery with a metal object, the battery could re-heat, emit hydrogen gas, undergo spillage, burn or explode.
- The user should use batteries provided by Televés, which are appropriate for this equipment.

3.3.2.6.2.- Battery regeneration

The **FSM 450** disposes of a function which carries out a recycling of the batteries. This option regenerates the batteries when the duration of the batteries has dropped considerably.

This process should only be carried out if the powering without supply from the mains has been reduced drastically since a repeated use of this function can shorten the battery life.

For the regenerating process to take place, it is necessary to externally power the meter continuously for 15 hours.

To start this process, the user must be inside this menu and then press

. Another screen appears which explains the process and by pressing

again, the process begins. If any other key is pressed, the meter returns to its previous state.

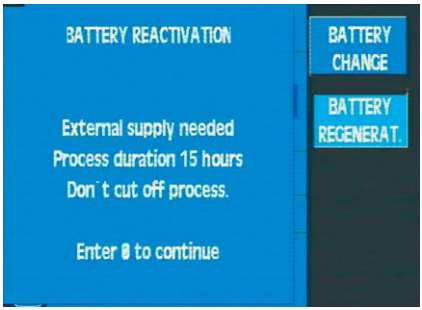


Figura 41.- Battery regeneration

When the charging process begins, the meter will switch off while the battery light and the ON light will flash on and off.

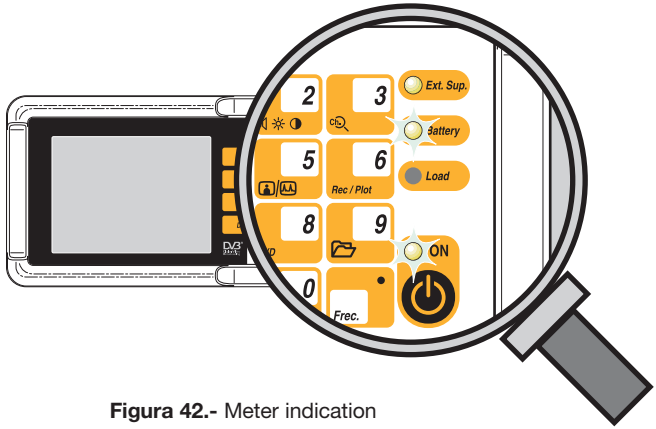


Figura 42.- Meter indication

Once this process has finished, the ON light will switch off and the battery light will switch on.

If, after this process, it is not possible to see an increase in the battery life, it is advisable to change the batteries.

3.3.3.- TV mode (short cut button 5)

When this menu is selected, the equipment switches automatically to TV mode, in other words, the user will see the demodulated television signal of the tuned channel onscreen.

Figure 43.- TV mode options

The corresponding submenu is the following:

3.3.3.1.- Viewing mode

The functions of this menu let you choose the elements that you wish to see on the screen of the meter; the bar indicating the level, the representation of the synchronism burst and the measurement window.

3.3.3.1.1. Bar

On the upper part of the screen, there is a horizontal bar which indicates the signal level of the tuned frequency in green (if it is in frequency tuning) or the video carrier level (if it is in channel tuning). As well as the signal level, other additional information may appear; if a V/A measurement is being carried out, a red bar will appear on top of the green bar which indicates the audio carrier level, and if the C/N is being measured, the noise level that is measured will appear in red. This is explained in greater detail in the corresponding sections.

If this option is pressed again, the bar disappears.

Figura 44.- Indication via bars

3.3.3.1.2.- Synchronism

This option displays the representation of the synchronism burst on the left-hand side of the screen.

If a digital measurement is being carried out (power, C/N, BER, MPEG), it will not be possible to see the synchronism burst, as the meter supposes that the tuned channel is digital and therefore does not represent this burst.

If this option is pressed again, the synchronism burst disappears.

Figura 45.- Synchronism indication

As you can see, the backgrounds of the level bar and the synchronism burst are transparent so that they do not interfere with the image onscreen.

3.3.3.1.3.- Measurements window (short cut button 4)

When this option is selected, the window that corresponds to the last measurement that was carried out, opens. In other words, if the last measurement that was carried out was the C/N (for example), the C/N window will open and the C/N measurement will be carried out in the tuned channel.

As was the case before, to close the window, you simply need to select the same option again.

However, if the level measurement appears, there are two different windows that represent this measurement: the abbreviated and the extended windows. The first of these displays the tuned frequency (or channel) and the measurement. The extended window displays this information too, but also displays some information on the audio carrier, the colour standard, the channel plan, the resolution filter, the current that is being supplied to the preamplifiers and if the 22 MHz tone is enabled.

The first time that this option is pressed, the abbreviated window appears, if this option is pressed again, the extended window appears, and if it is pressed again, this option closes.

These windows will be explained in greater detail in the *Measurements-Level* section.

It is also necessary to note that the short cut button is not operative when a digital measurement is selected, in other words, once a digital measurement window is opened, it will not be possible to close it, the user will be able to substitute it for another, but there will always be a measurement window open. This is because as there is nothing onscreen about the TV signal, it is not necessary to close all the windows, as the screen would turn black and this could cause confusion.

Below, you can see an example of the screen with all of these elements on display:

Figure 46.- Extended window

3.3.3.1.4.- Teletext

When this function is selected, the teletext information of the tuned channel will appear onscreen (if the channel does not dispose of this information, NO TTX will appear). The representation level of the teletext function is 1.5

Figure 47.- Teletext window

We can travel through the teletext pages using the rotating knob. We can access a teletext page by pressing **Freq.** and then entering the page number. To return to the picture from the TV signal, you need to press the Teletext button again.

3.3.3.2.- Measurements

When we select a specific measurement, a window will open which will display the measurement just carried out and the frequency (or channel) of the measurement, which corresponds to the frequency (or channel) that the user has tuned.

It is possible to vary the tuned frequency as you watch the measurement window. In this way, we can carry out the same measurement in consecutive frequencies (or channels) very simply. To vary the frequency, use the rotating knob or the number pad. To enter the frequency with the keyboard, press the **Freq.** button until the frequency information that appears in the window is erased. Now you will be able to enter the frequency using the keyboard. It is important to remember at this point that to insert the dot that separates the decimals, you also need to use the **Freq.** button.

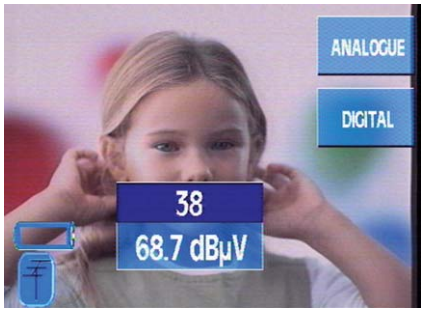


Figure 48.- Measurement menu

3.3.3.2.1.- Analogue measurements (short cut button 8 A/D)

The corresponding submenu is as follows:

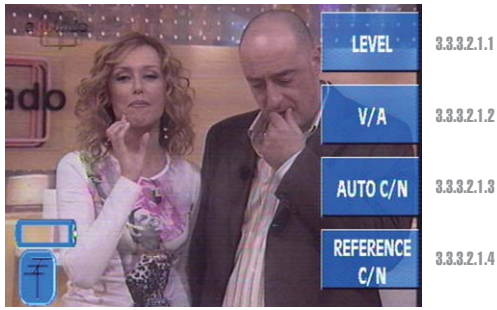


Figure 49.- Analogue measurements

3.3.3.2.1.1.- Level

If the channel tuning mode has been selected, this function will measure the carrier level of the tuned channel. If, however, the frequency tuning mode has been selected, the signal level of the tuned frequency will appear in the window.

As we have already seen in the *Viewing mode - Measurements* section, there are two possible windows for the level measurement (abbreviated and extended). Below you can see an example of a level measurement window in its abbreviated form:

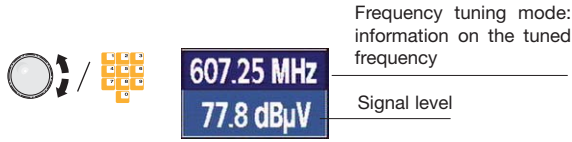


Figure 50.- Abbreviated form

You can vary the frequency by using the rotating knob (in the terrestrial band with a resolution of 50 KHz and in the satellite band 100 KHz), or by using the number pad.

In the extended window, the following information appears:

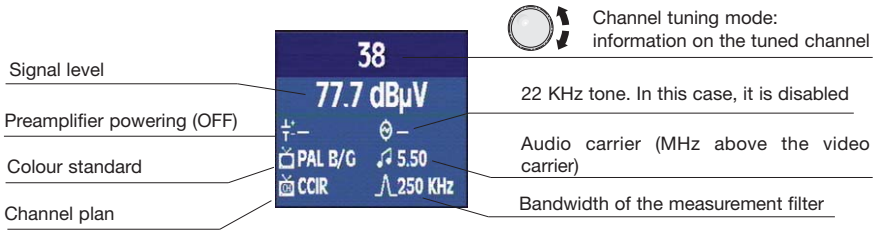


Figure 51.- Extended form

3.3.3.2.1.2.- V/A (only the terrestrial band)

The window that appears when carrying out this measurement is the following:

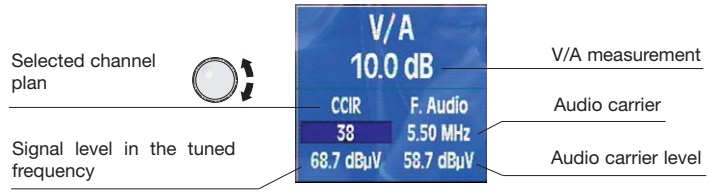


Figure 52.- V/A measurement. Channel tuning

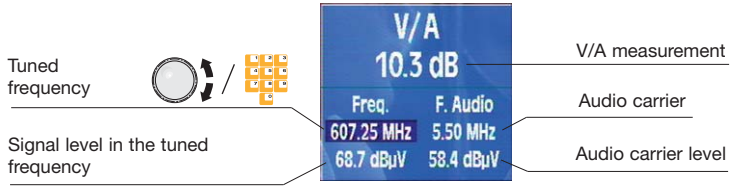


Figure 53.- V/A measurement. Frequency tuning

The tuned frequency is taken as the video carrier, in other words, it is where the video level is measured. The audio carrier level is taken to be as many MHz higher as indicated in the Audio information that appears onscreen (5.50 in the example). By pressing the **Freq.** button, the information on the tuned frequency is highlighted. Once this has been done, we can vary the tuning by using the rotating knob or the number pad.

If we press the **Chan.** button, the information on the tuned channel will appear. The frequency that is used to carry out the video level measurement will be the video carrier of the channel that the equipment searches for automatically.

Therefore, when the equipment is in frequency tuning mode, it is the user's responsibility to make sure that the tuned frequency is really the video carrier of the channel that the V/A measurement is to be carried out on, in order for the measurement to be totally correct.

If the level bar is visible when the V/A measurement is being carried out (see section *3.3.3.1.1.- Bar*), two overlapping bars will appear, one in green which indicates the video carrier level (channel tuning) or the tuned frequency level (frequency tuning), and the other in red which indicates the audio carrier level.

Figure 54.- Indication of V/A using the bars

3.3.3.2.1.3.- Automatic C/N

When this function is selected, a window with the carrier / noise ratio will appear automatically onscreen. The window that appears is the following:

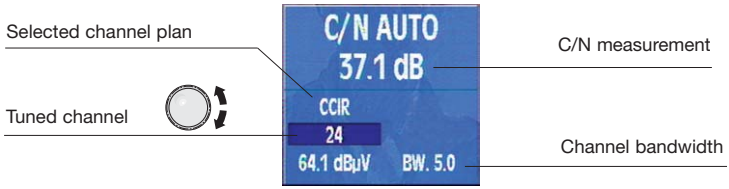


Figure 55.- Automatic C/N measurement. Channel tuning

Figure 56.- Automatic C/N measurement. Frequency tuning

If in channel tuning mode, you will be able to see the channel with the carrier that is being used to carry out the level measurement. As has already been explained in the section regarding the V/A ratio measurement, if the equipment is in frequency tuning mode, the level measurement will be carried out in the frequency that the user has tuned, and so it will be the user's responsibility to make sure that this frequency corresponds to the real channel carrier.

If the level bar is visible when the C/N measurement is being carried out (see section *3.3.3.1.1.- Bar*), two overlapping bars will appear, one in green which indicates the video carrier level (channel tuning) or the tuned frequency level (frequency tuning), and the other in red which indicates the measured noise level.

Figura 57.- Indication of C/N via bars

This function has the following submenu:

3.3.3.2.1.3.1.- Channel BW

When this option is pressed, a small window opens on top of the previous window, displaying the value of the video bandwidth which will be taken into account when automatically compensating the noise (we recommend 5 MHz for this measurement). As the user turns the rotating knob, the different options will appear. To select a value, press this knob.

3.3.3.2.1.4.- Referenced C/N

When this function is selected, the video signal automatically disappears from the screen. This is because the equipment has to carry out the noise measurement in the reference frequency. Because of this, the ***button is not enabled.***

The window that appears when this function is selected is the following:

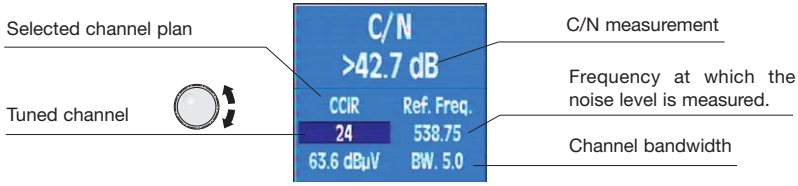


Figura 58.- Referenced C/N measurement. Channel tuning

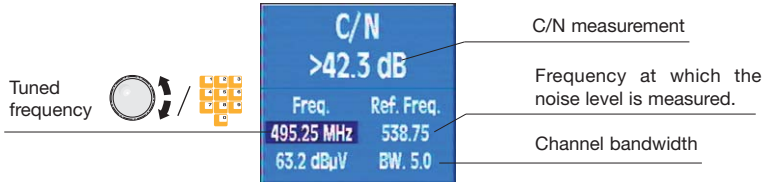


Figure 59.- Referenced C/N measurement. Frequency tuning

If in channel tuning mode, you will be able to see the channel with the carrier that is being used to carry out the level measurement. As has already been explained, if the equipment is in frequency tuning mode, the level measurement will be carried out in the frequency that the user has tuned, and so it will be the user's responsibility to make sure that this frequency corresponds to the real channel carrier.

To carry out this measurement, it is necessary to indicate two parameters; the **frequency** at which you want to measure the noise level (reference frequency) and the **channel bandwidth**. To do so, this function has the following submenu:

3.3.3.2.1.4.1.- Reference frequency

By pressing this option, the noise frequency is highlighted in the window (dark background). You can vary the noise frequency by using the rotating knob. Once the reference frequency has been selected, if you press the **Freq.** button, the current frequency is erased and the you can enter the frequency that you want by using the number pad.

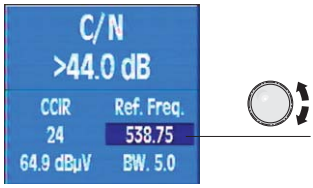


Figure 60.- Reference frequency

3.3.3.2.1.4.2.- Channel BW

When this option is pressed, a small window appears over the previous window which displays the video bandwidth that will be taken into account when automatically compensating for the noise (we recommend 5 MHz). When rotating knob is turned, the different options appear. To select the value that you want, simply press the rotating knob.

Figure 61.- Channel bandwidth

3.3.3.2.2.- Digital measurements (short cut button 8 A/D)

When a digital measurement is selected, the image from the TV signal will disappear from the screen, and a warning message will appear that indicates that this is a digital measurement.

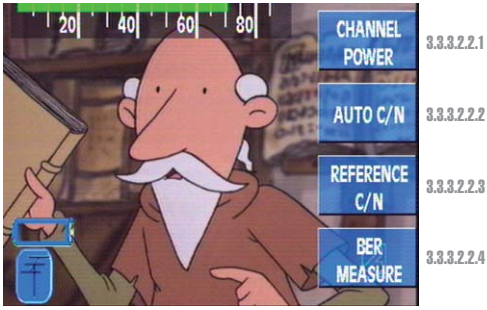


Figure 62.- Options for digital measurements

3.3.3.2.2.1.- Channel power

If the equipment is in TV mode, when this function is selected, the image from the TV signal will automatically disappear from the screen, and a warning message will appear that indicates that this is a digital measurement, as can be seen in the following figure.

If the frequency tuning mode is selected, the tuned frequency will be taken as the **intermediate frequency of the digital channel**. As in the measurements that have already been explained, the user can use the rotating knob or the number pad to vary the frequency (or the channel) in which the measurement is to be carried out. The power measurement will be carried out by using the bandwidth that was entered by the user and by using its value that appears in the measurement window.

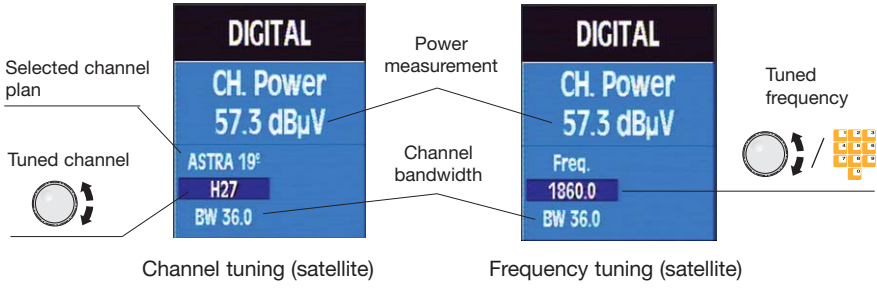


Figure 63.- Digital channel power

To change this parameter, the following submenu appears:

3.3.3.2.2.1.1.- Channel bandwidth

If this option is pressed, the value of the bandwidth is selected in the channel power window. You can change this value by using the rotating knob:

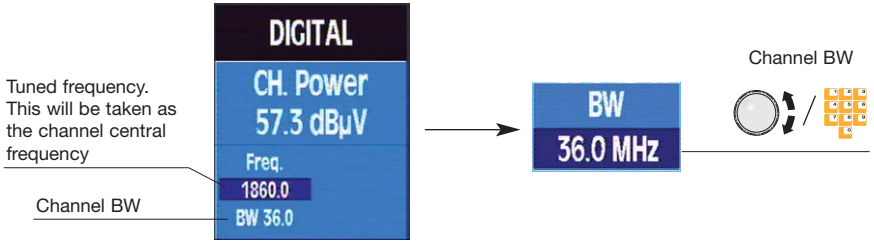


Figure 64.- Bandwidth

3.3.3.2.2.2.- Automatic C/N

This function is the same as the automatic C/N in the analogue channels. Above the window, it is possible to see that this is a digital measurement.

3.3.3.2.2.3.- Referenced C/N

This function is the same as the referenced C/N in the analogue channels. Above the window, it is possible to see that this is a digital measurement.

3.3.3.2.2.4.- BER measurement

The submenu of this function varies, depending on the band that is selected (either terrestrial or satellite).

When the BER is being measured, the Network Provider information, the Number of Services and the name of the Services will be displayed at the bottom of the window.

Terrestrial band Satellite band

Figure 65.- Options for the BER measurements

The window that opens when any of the modulations is selected is the same, however the type of modulation varies:

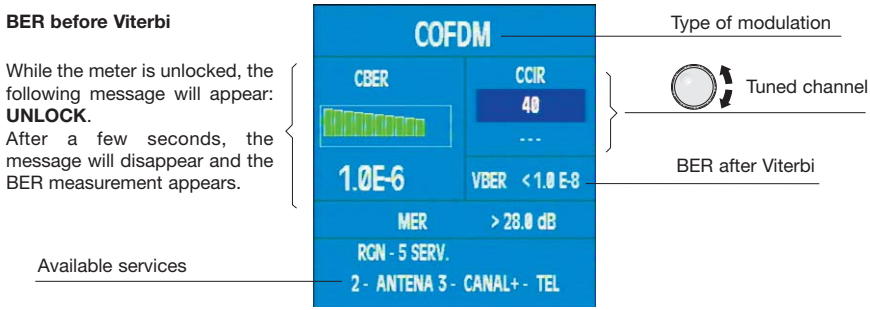


Figure 66.- BER measurement window

To indicate if the CBER measurement is at an acceptable threshold, the colour of the bars varies. When the CBER is red, this indicates that the signal quality is bad. When the CBER measurement is yellow, this indicates that the signal quality is acceptable but it would be better to improve it. If the CBER measurement is green, this indicates that the signal quality is good.

It is very important to take into account that the CBER parameter determines quite clearly the quality of the installation. This is why we have simplified the interpretation of this parameter with these colours. The VBER is a parameter that has practically only got two states, either very good or very bad, which makes it difficult to use to appropriately evaluate the installation. This is why we recommend using the CBER status to assess the quality of the installation (it should be a small as possible).

3.3.3.2.2.4.1.- COFDM (only terrestrial band)

Carry out the BER measurement of the digital terrestria signals with COFDM modulation. The submenu for this type of modulation is the following:

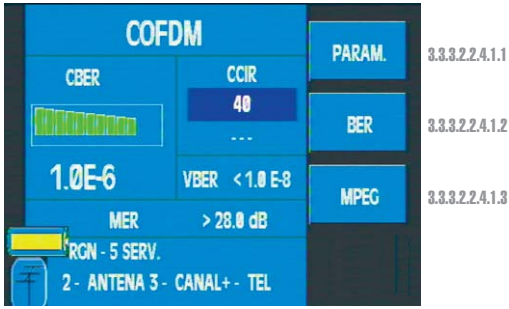


Figure 67.- COFDM measurements

3.3.3.2.2.4.1.1.- Parameters

When this menu is selected, a window appears on top of the BER measurement window which displays a list of the parameters that can be selected. To vary a specific parameter, use the rotating knob (selecting and pressing), a window will appear with a list of all the possible values for this parameter. The parameters tha can vary in COFDM are: Number of carriers (**2K**, **8K**, **AUTO**), Spectrum Inversion (**ON**, **OFF**, **AUTO**), Guard Interval (**1/32**, **1/16**, **1/8**, **1/4**, **AUTO**), Offset (**0, 1/6**, **2/6**, **3/6**, **-1/6**, **-2/6**, **-3/6**, **AUTO**). When the AUTO option is selected in any of the parameters, the equipment automatically selects the appropriate option, although the locking time will increase.

Below is an example of a parameter selection window:

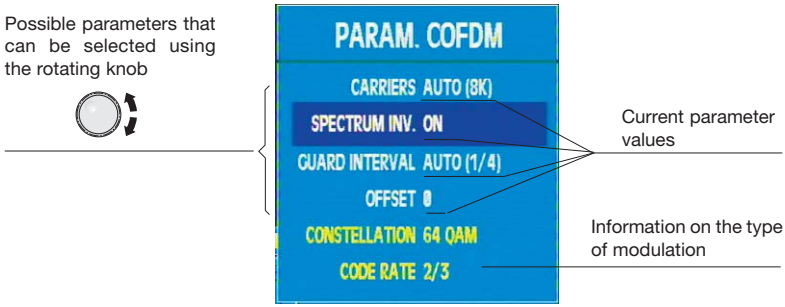


Figure 68.- COFDM parameters

When the rotating knob is pressed, the window that corresponds to the selected parameter opens:

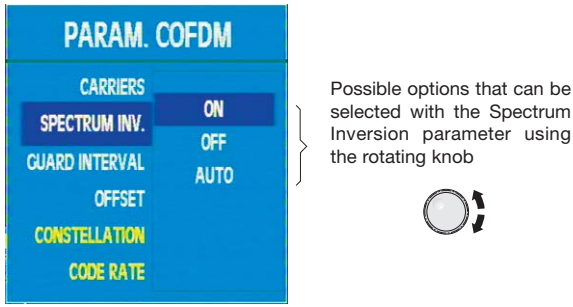


Figure 69.- COFDM parameter options

In the Offset option, if the COFDM channel has a frequency deviation, you can apply an offset (**0, 1/6, 2/6, 3/6, -1/6, -2/6, -3/6, Auto**) to correct this deviation.

This **will only be valid in channel mode** and you can select it by choosing the current COFDM channel.

The selection can be **manual** or **automatic**. When you select the automatic option, the equipment will automatically detect the offset. This may take a few moments as a scan is carried out for with all the possible offsets.

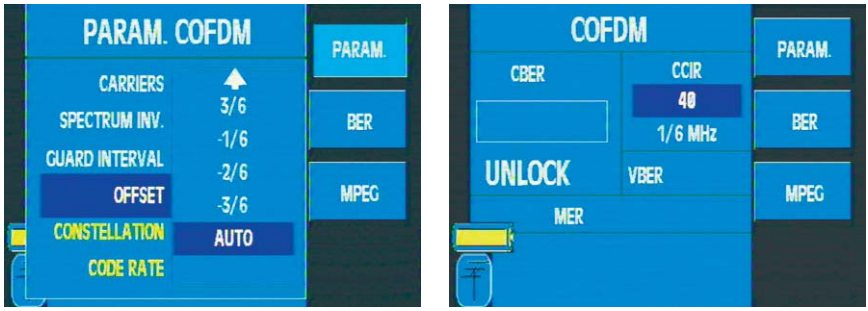


Figure 70.- Determining a COFDM offset

The parameter window will display the information on the constellation being used in each carrier and the code rate in yellow.

3.3.3.2.2.4.1.2.- BER

When this function is selected, the error packet window closes and the BER measurement window appears again.

3.3.3.2.2.4.1.3.- MPEG

By pressing on this option, the MPEG decoding is enabled. The message "*STARTING MPEG*" will appear and then the search for the available services will begin, with the message "*SEARCHING SERV.*".

If we do not dispose of a COFDM signal, the screen will display "*UNLOCK*".

By using the rotating knob we can access the list of channel services. When the desired channel has been found, press Enter to confirm the choice. Now it is necessary to select the desired audio.

Figura 71.- MPEG decoding of a COFDM channel

In this option there is an extended window (short cut 4) which displays some information about the tuned channel: the number of services, the selected service (if it is a scrambled channel, # will appear beside the name), the SID network identifier, VPID (for the audio channels the value 0 will appear) and the APID.

The network identifier is also displayed (NID), if this value is unknown, then this number will be displayed in hexadecimal format.

Figura 72.- Channel information

Note: *It is possible to change service at any moment by using the rotating knob*.

To change channnel press

.

3.3.3.2.2.4.2.- QAM (only terrestrial band)

When this function is selected, the equipment measures the BER of a digital signal with QAM modulation. The information window is identical to the previous one. The submenu for this function is the following:

Figure 73.- QAM measurements

It is very important to take into account that the CBER parameter determines quite clearly the quality of the installation. This is why we have simplified the interpretation of this parameter with these colours. The VBER is a parameter that has practically only got two states, either very good or very bad, which makes it difficult to use to appropriately evaluate the installation. This is why we recommend using the CBER status to assess the quality of the installation (it should be a small as possible).

3.3.3.2.2.4.2.1.- Parameters

The parameters that can be selected for a QAM signal are: Symbol rate (**6875**, **6111**, **5156**, **4583**, **5893**, **5238**, **6900**, **OTHER (6875)**), Constellation (**4QAM**, **16QAM**, **32QAM**, **64QAM**, **128QAM**, **256QAM**, **OTHER**), and Spectrum Inversion (**ON**, **OFF**, **AUTO**). These parameters are selected in exactly the same way as those with COFDM modulation.

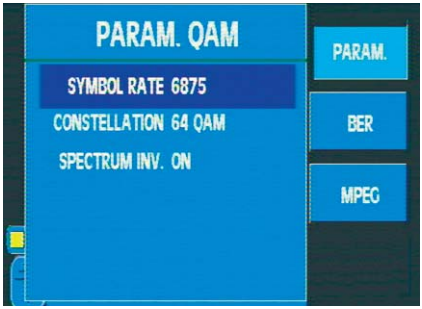


Figura 74.- Parameter options

3.3.3.2.2.4.2.2.- BER

When this function is selected, the parameters window closes and the BER measurement window appears again.

3.3.3.2.2.4.2.3.- MPEG

By enabling this option, the user enters the MPEG decoding mode in a QAM channel. The operation mode is similar to MPEG of COFDM (see 3.3.3.2.2.4.1.4).

Figura 75.- MPEG decoding of a QAM channel

3.3.3.2.2.4.3.- QPSK (only the satellite band)

This function measures the BER of a digital signal with QPSK modulation. The information window is exactly the same as the window for the QAM and COFDM modulations. The submenu is the following:

Figure 76.- QPSK measurements

3.3.3.2.2.4.3.1.- Parameters

The parameters that can be selected for a QPSK signal are the following: Symbol Rate (**27500**, **24500**, **22000**, **15000**, **OTHER**), Code (**Auto**, **2/3**, **3/4**, **5/6**, **7/8**, **1/2**), and Spectrum Inversion (**ON**, **OFF**, **AUTO**). The parameters are selected in the same way as with the previous functions.

3.3.3.2.2.4.3.2.- BER

When this function is selected, the error packet window closes and the BER measurement window appears again.

It is very important to take into account that the CBER parameter determines quite clearly the quality of the installation. This is why we have simplified the interpretation of this parameter with these colours. The VBER is a parameter that has practically only got two states, either very good or very bad, which makes it difficult to use to appropriately evaluate the installation. This is why we recommend using the CBER status to assess the quality of the installation (it should be a small as possible).

3.3.3.2.2.4.3.3.- MPEG

With this option, the MPEG mode of a QPSK channel is enabled. The functions in the same way as in QAM and COFDM.

3.3.3.3.- Channel search (short cut button 3)

The **FSM 450** features an automatic channel search function. The search is carried out according to a certain threshold as defined by the user in the Search Level.

It also depends on whether the meter is in channel tuning mode or frequency tuning mode.

If the meter is in channel tuning mode, it is carried out according to the selected channel plan. The equipment automatically searches for the corresponding channel according to the plan and if the video carrier level is higher than the search level, then the channel is tuned in. If it is not, it progresses onto the next channel, and so on until it finds a channel with a video carrier level higher than the threshold defined by the user.

If however, the meter is in frequency tuning mode, the selected channel plan is not taken into account. Instead the meter uses the frequencies in the spectrum. When the equipment finds a frequency that is higher than the established threshold, it carries out a selective search within a specific margin of frequencies to find the maximum and then it tunes that frequency as the video carrier. If, once a channel has been tuned in this way, the equipment switches to channel tuning mode, the tuned channel may not be in the selected channel plan, so the equipment will tune the nearest channel within this plan.

The automatic channel search can be a very useful function when checking an installation. Thanks to this function, it is possible to see the channels automatically and in sequence, without having saved the channels previously or even without knowing which channels are present.

This menu has the following submenus:

Figure 77.- Channel search options

3.3.3.3.1.- Search level

This parameter defines the threshold that the video carrier must surpass for the equipment to tune a specific channel when carrying out an automatic search. When this function is selected, a window opens onscreen, and the value of the search level can be modified using the rotating knob. The possible values range from 40 and 120 dBµV.

It is best to program a search value that is close to the signal level that we are using in the equipment, in other words, if we want to scan through the channels of a headend quickly using this function, if the headend output is at approximately 115 dbµV, the correct way to proceed is to program search values that are higher than 110 dbµV.

If we enter values that are very low compared to the level that we are using (for example 60 dbµV in this case), we are helping to saturate the equipment and using this function incorrectly.

Figure 78.- Search level

3.3.3.3.2.- Next

This tunes the channel that has a video carrier level that surpasses the search level and that is immediately next in frequency to the tuned channel.

3.3.3.3.3.- Previous

This tunes the channel that has a video carrier level that surpasses the search level and that is immediately before in frequency to the tuned channel.

3.3.3.4.- Selecting the Audio Carrier

The options that appear here depend on the band and on the colour standard that has been selected:

Band	Terrestrial	Satellite
PAL B/G	5.50 & 5.74	7.02 & 7.20
PAL D/K	6.50 & 6.74	
PAL I	6.00	
SECAM B/G	5.50 & 5.74	
SECAM L	6.50 6 5.85	
SECAM D/K	6.50 & 5.85	

To select the option that you want, use the rotating knob.

As well as the frequencies of the audio carrier of each standard, there are two more option in the window: **Freq.** and **Level**. If we select **Freq.**, the audio carrier selection window will close and another window will open in which the user can select another frequency from “4,00” to “9,00” using the rotating knob. The **Level** option activates the audio signal that indicates the carrier level. This is a tone which changes according to the variations in the signal level, in other words, the higher the level, the higher the tone (higher frequency).

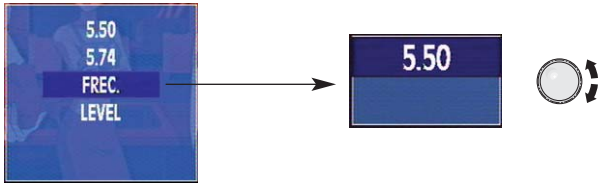


Figure 79.- Audio carrier

To close the window use the **Clear** button.

3.3.4.- Spectrum (short cut button 5)

If this menu is chosen, the meter passes straight to the spectrum analyzer mode. In this mode you can see the signal spectrum according to the selected span and the tuned frequency. The lower part of the screen (under the spectrum) is used to display the parameters, measurements, etc. The menu texts are hidden by default, so that it is easier to see the spectrum properly.

When you need to access the menus, simply press the **Clear/Menu** button or any of the A B, C or D buttons.

If an analogue measurement is selected, the central part of the spectrum will display a dotted yellow line, and if a digital measurement is selected, this line does not appear and instead there are two dotted yellow lines at an equal distance from the spectrum's central line. The separation between these lines indicates the channel bandwidth that is selected at that moment.

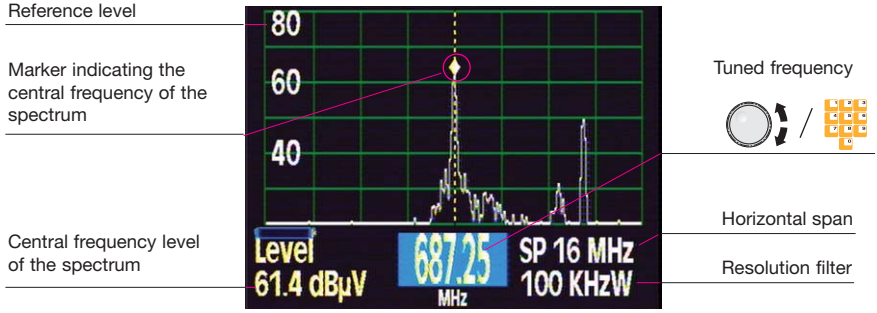


Figure 80.- Spectrum analyzer mode. Frequency tuning (analogue channel)

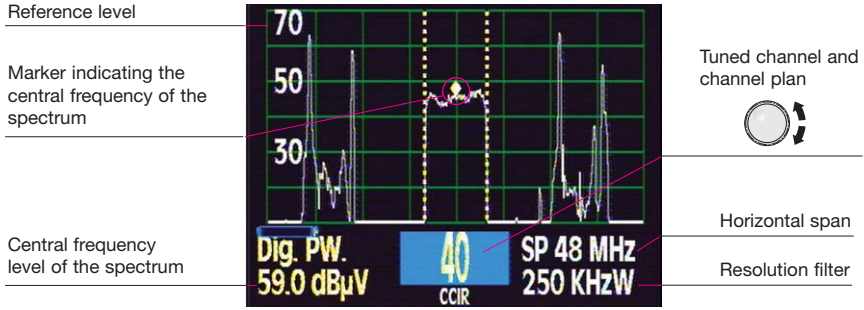


Figure 81.- Spectrum analyzer mode. Channel tuning (digital channel)

The information about the tuned frequency or channel appears at the bottom of the screen.

If the equipment is in frequency mode, the central frequency of the spectrum will appear. If we turn the rotating knob, we can change the central frequency, in other words, we move the spectrum to one side or the other.

If the equipment is in channel tuning mode and in analogue mode, the channel with the tuned frequency will appear and the spectrum will automatically be centred on the frequency of the video carrier of this channel. In digital mode, it is positioned in the centre of the channel. If we turn the rotating knob while in channel mode, we will pass onto the next channel and the spectrum will go to the next video carrier.

The corresponding submenu is the following:

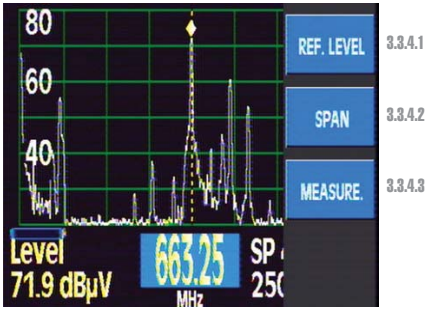


Figure 82.- Spectrum mode options

3.3.4.1.- Reference Level

This allows you to select the reference level of the spectrum in order to optimize the view of the spectrum of the signal according to its level. The reference level corresponds to the value of the upper horizontal line of the spectrum. The possible values are from 60 dBµV to 130 dBµV in steps of 10 for the terrestrial band, and up to 120 dBµV in the satellite band. When this function is chosen, the infomation about the level disappears for a moment and reference level options appear in its place. These are all viewed by turning the rotating knob. When it is pressed, the value is selected. Then the reference level information disappears and the signal level information re-appears. Any changes in this value can be seen on the spectrum. This makes it easier to know which reference level value is the best for the optimum viewing of the spectrum.

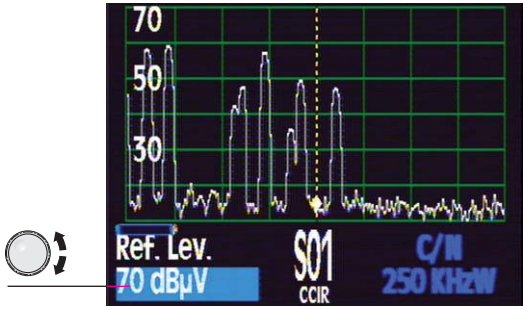


Figure 83.- Reference level

3.3.4.2.- Span

This function lets you vary the range of frequencies that is represented by the spectrum. The information for the selection of the parameter is displayed on the lower right-hand part of the screen. As is the case with the Reference Level, the information about the level disappears for a moment and the information about the span appears. The different options for this parameter appear as the rotating knob is turned. When the rotating knob is pressed, the value is selected and the menus disappear from the screen.

The possible values in the **FSM 450 meter** are:

Terrestrial band: 8, 16, 32, 48, 96, 192, 496 MHz, Full Span

Satellite band: 25, 50, 100, 200, 512 MHz, Full Span

3.3.4.3.- Measurements

The measurements are displayed at the bottom of the screen. While any measurement is being viewed, the tuned frequency can be varied by turning the rotating knob. This means that the measurement can be carried out with different frequencies or channels.

When a measurement is selected, the texts automatically disappear from the menus so that they do not stop the user from seeing the selected measurement and the signal spectrum properly.

The measurements submenu in spectrum mode is the same as the submenu in TV mode:

3.3.4.3.1.- Analogue

3.3.4.3.1.1.- Level

The measurement of the level is seen on the lower left-hand part of the screen. The frequency that is used for this measurement is the spectrum's central frequency (see the mark). If you vary the tuned frequency with the rotating knob, you will see how the level measurement also changes.

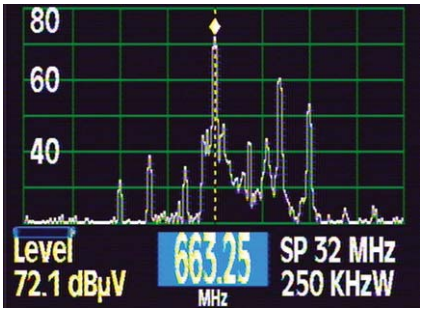


Figure 84.- Signal level

3.3.4.3.1.2.- V/A

The measurement of the audio carrier level/ video carrier level ratio is displayed on the lower right-hand part of the screen. The spectrum's central frequency is taken as the carrier frequency, and the audio carrier level is measured in the frequency that is indicated in the audio carrier selection (this function is in *TV Mode - Sel. Audio Carrier).*

On the left-hand side, you can see the measurement of the central frequency level.

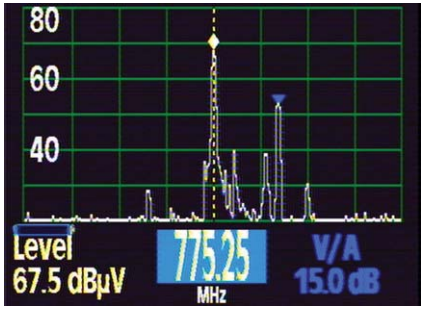


Figure 85.- A/V carrier ratio

3.3.4.3.1.3.- Automatic C/N

The C/N measurement is also displayed on the lower part of the screen.

As is the case with the V/A measurement, the carrier level is measured in the spectrum's central frequency

The equipment selects the frequency that is used to measure the noise.

3.3.4.3.1.4.- Referenced C/N

In the case of the referenced C/N, the frequency that is used to measure the noise must be selected by the user. When using this function, a second blue marker appears on the spectrum, indicating the frequency that is being used to measure the noise.

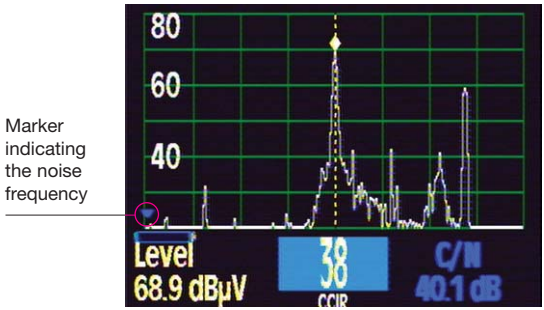


Figure 86.- Referenced C/N

To access the submenu of this function where the frequency at which the noise level is measured and the channel bandwidth are selected, you must press the **Clear/Menu** button. The menus will appear again and we can select these parameters. The options for these

parameters are displayed on the lower left-hand part of the screen; the level measurement disappears for a moment, and once the desired value has been selected (by pressing the rotating knob), the level measurement re-appears:

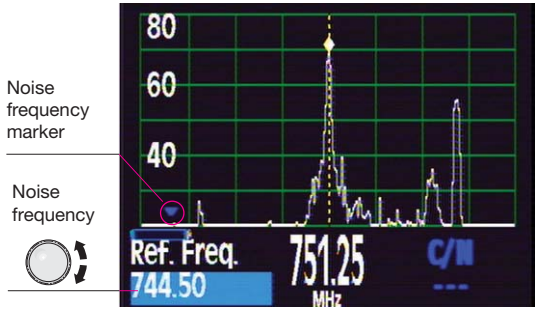


Figure 87.- Noise measurement

3.3.4.3.1.4.1.- Reference frequency

This function lets you vary the frequency that will be used to measure the noise. The rotating knob moves the blue marker so that it passes through all of the frequencies that are visible onscreen. Once the marker is over the desired frequency, press the rotating knob. This will now be used as a reference to measure the C/N.

It is important to point out that the noise frequency marker (blue) can only be moved through the frequencies that can be seen onscreen. Therefore, if the user wants to select another frequency that is not in this range, it will be necessary to select a greater horizontal span.

3.3.4.3.1.4.2.-Channel bandwidth

To take a correct measurement of the C/N, the user must select the channel bandwidth, as this is the parameter that will be used to correct the value of the noise level that is measured using the reference frequency in order to apply it to the whole channel bandwidth.

3.3.4.3.2.- Digital

3.3.4.3.2.1.- Channel power

The channel power is displayed on the lower left-hand part of the screen. For this measurement, the meter takes the spectrum's central frequency (the tuned frequency) to be the central frequency of the digital channel. This is important if the channel power is to be measured correctly. To carry out this measurement it is also very important to select the channel bandwidth.

The equipment carries out the calculation of the digital power automatically (lower left-hand part of the screen). When choosing the reference level, it is important for the digital power of the channel not to surpass this reference, as the equipment would become saturated and the results may not be correct.

See that the digital power is clearly higher than the analogue level that the equipment indicates.

The submenu allows us to select the channel bandwidth.

Figure 88.- Power of a digital channel

3.3.4.3.2.1.1.- Channel bandwidth

When this parameter is being selected, the information about the channel power measurement disappears and the channel bandwidth appears in its place. This can be modified using the rotating knob. To select the desired value, press the rotating knob. The bandwidth information will disappear and the power measurement information will appear again.

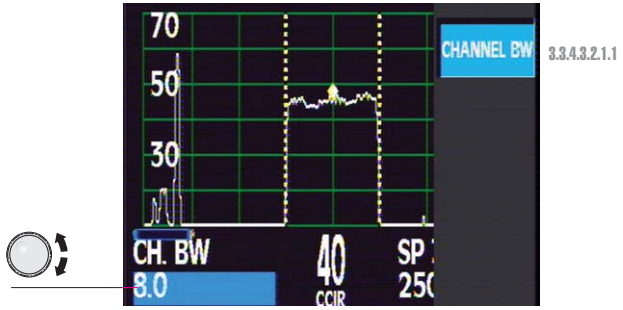


Figure 89.- Bandwidth of the digital channel

3.3.4.3.2.2.- Automatic C/N

The automatic C/N measurement for digital channels is the same as for analogue channels. This function has the following submenu:

3.3.4.3.2.2.1.- Channel bandwidth

When this parameter is selected, the information about the channel power measurement disappears and the channel bandwidth appears in its place. This can be modified using the rotating knob. To select the desired value, press the rotating knob. The bandwidth information will disappear and the power measurement information will appear again.

3.3.4.3.2.3.- Referenced C/N

The measurement of the C/N of digital channels is also displayed on the lower left-hand part of the screen. The user must select the frequency value that will be used to carry out the noise measurement and the channel bandwidth. This function has the following submenu:

3.3.4.3.2.3.1.- Reference frequency

This function lets you vary the frequency that will be used to measure the noise. Use the rotating knob to move the blue marker through the range of frequencies that are visible onscreen. Once the marker is signalling the desired frequency, press the rotating knob. The C/N measurement will be carried out using this frequency as the noise reference.

3.3.4.3.2.3.2.- Channel bandwidth

When this parameter is selected, the information about the channel power measurement disappears and the channel bandwidth appears in its place. This can be modified using the rotating knob. To select the desired value, press the rotating knob. The bandwidth information will disappear and the power measurement information will appear again.

3.4.- ERROR WARNINGS

When the equipment detects an error in any of the modules or components, it warns the user through a series of messages as can be seen below:

- **NO BAT. :**

  This message appears when the equipment is switched on and no batteries are detected. The equipment operates correctly while connected to the mains.

  The same message appears when the user wishes to charge the batteries and there are no batteries connected to the equipment.

- **WRONG BATT:**

  This message appears when the equipment is switched on and when the batteries that are being used are not the same as the ones that come with the equipment from the factory or when the position of the configuration microswitches of the battery (side of the equipment) are not in the correct position. When the equipment displays this error message, it is impossible to charge the batteries (*see section 3.3.2.6.2*).

- **FULL BAT :**

  This message will appear when the user tries to charge a battery that is already charged.

- **EXCES TEMP:**

  The equipment continuously monitors the temperature. When it is too high, this message flashes onscreen. If the temperature does not go down, the equipment shuts down automatically. If the temperature goes down, the message disappears.

  If this message appears, it is advisable to improve the conditions in temperature. The user can carry out various modifications, for example, place the equipment in a more ventilated area, take away any objects that may be blocking its ventilation, stop charging the batteries (button) if the equipment is in use.

  If this warning message does not disappear, it is advisable to switch the equipment off while **keeping the external power supply connected**, to facilitate the elimination of the internal heat.

- **ERROR XXXX:**

  When the equipment is switched on, it checks all of its modules. When it detects an error in any of these, an **ERROR** message will appear followed by a code. If this happens, please contact your local Televés distributor, informing him/her of this error code.

- **ERR CHARGE:**

  When the DC adapter is connected to the equipment, this checks the current in the external powering connector (31). If the equipment detects an erronious current, it warns the user via an error message which flashes onscreen. The **Ext. Supply** LED will also flash.

- **Vext.:**

  This error message appears when the voltage of the external units is selected and when the equipment detects a different current in the “F” connector than that selected by the user.

· **NO POWERING:**

This message appears when the user tries to charge the batteries and there is no external powering.

· **SHORT CIRCUIT:**

This message appears when the equipment detects a shortcircuit in the “F” connector. The equipment will also emit a noise. The powering will be cut off and it will try again every 3 seconds.

· **EXCES CURRENT:**

This message appears when the power consumption surpasses the maximum allowed. The powering is cut off and it will try again every 3 seconds.

· **No DiSEqC. Vdc off:** This message appears when one of the DiSEqC inputs is selected when the powering of external units is switched off.

4.- DESCRIPTION OF THE INPUTS AND OUTPUTS

4.1.- RF INPUT

The RF input is through the connector (30) on the side panel. The maximum signal level should never exceed 130 dBµV. This connector is easily replaced when this becomes necessary.

4.2.- RS-232C SERIAL PORT

The **FSM 450** features an RS-232C serial port for exchanging data with a PC or any other device. The signals in this connector are described below:

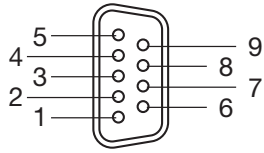


Figure 90.- RS 232 connector

PIN Nº	SIGNAL	SPECIFICATIONS
1	-	(not connected)
2	Data Request (RxD)	
3	Data Transmit (TxD)	
4	-	(not connected)
5	Ground (GND)	
6	-	(not connected)
7	-	(not connected)
8	-	(not connected)
9	-	(not connected)

4.3.- SCART (DIN EN 50049)

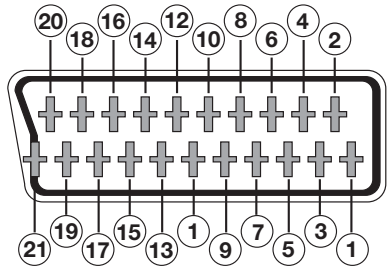


Figure 91.- SCART

Also known as a PERITEL connector (in compliance with standard NF-C92250).

The signals in this connector are as follows:

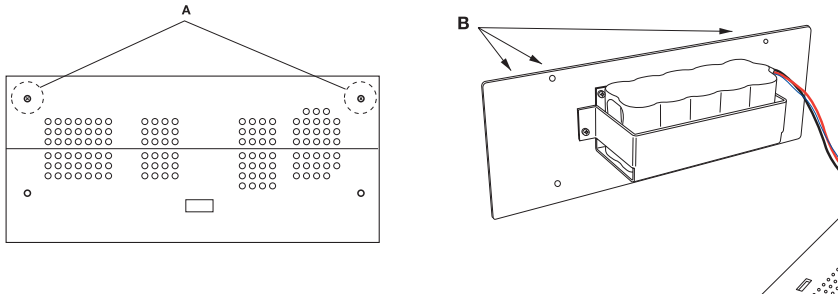
PIN Nº	SIGNAL	SPECS.	PIN Nº	SIGNAL	SPECS.
1	Right ch. audio output		12	Digital bus interface	(N/C)
2	Right ch. audio input		13	Red grounding (R)	
3	Left ch. output output		14	Digital bus reserved	(N/C)
4	Audio grounding		15	Red output (R)	
5	Blue grounding (B)		16	Blanked signal	(N/C)
6	Left ch. audio input		17	Composite video gnd	
7	Blue output (B)		18	Blanked return	(N/C)
8	Switching voltage		19	Composite video output	
9	Green grounding (G)		20	Video input	
10	Digital bus interface	(N/C)	21	Connector shield grounding	
11	Green output (G)				

5.- MAINTENANCE

5.1.- REPLACING THE BATTERY

The battery should be replaced when its capacity (fully-charged) has diminished considerably. To ensure that the equipment operates correctly, it should be provided by Televés, as it should incorporate the appropriate protective features.

To replace the battery, follow the procedure explained below:



- Switch the equipment off and disconnect the external power supply
- Remove the protective holster, if in place.
- Remove the 5 screws (A) that secure the top of the meter and take the top off.
- The battery compartment is located in the rear panel of the equipment. Remove the 4 fixing screws (B) as shown in the previous figure. Remove the rear panel.
- In order to remove the battery completely, you need to disconnect it from the connector that is located inside the meter. Follow the cables from the battery to find this connector.
- For the protective features of the batteries to work properly, place the new batteries in the same position as the old batteries.
- Connect the terminals to the new batteries. Remember to watch out for the position of the connector.
- Replace the panel and fix it securely using the 4 screws (B). Do the same with the top and the remaining screws (A). Finally replace the protective holster.
- Inform the software of the equipment of the change in batteries (*see section 3.3.2.6.1*).

WARNING

Avoid any type of shortcircuit between the cables to the battery as this could cause serious damage to the equipment.

Note: *Remember to dispose of the batteries in the appropriate places provided*

Ni-MH

5.2.- CLEANING INSTRUCTIONS

WARNING

Before cleaning the cover, make sure that the equipment is disconnected.

Do not use scented hydrocarbons or chlorinated solvents.

These products may harm the materials used for the cover.

The cover can be cleaned with a bit of normal cleaning liquid and water, using a soft damp cloth.

Dry thoroughly before using the equipment.

WARNING

Do not use alcohol or products containing alcohol to clean the front panel or the viewfinders, as these products may harm the mechanical properties of the materials used, and therefore reduce their operative life.

APPENDIX 1.- Battery

Below is a list of the safety measures that must be taken into account as regards the battery:

This equipment contains a Ni-MH battery packet.

- The **charging** of the battery should always be carried out with the battery located inside the meter and using the **DC adapter that is provided** with the equipment. This is the only way to guarantee their long life. The use of another battery charger may harm the battery packet or cause it to explode.
- **Do not connect** the battery directly to a **high voltage** source, such as the car lighter. This high voltage would harm the battery immediately
- **Do not cause a shortcircuit** in the battery packet and **do not put** the batteries into direct contact with **a metal object**. Isolating elements should be used that are resistant to heat and acid. Battery spillage without isolating elements can cause smoke and fire
- **Do not place** the batteries near to any element which may cause **sparks** (such as a fuse or a switch). The battery can produce inflammable gases when charged. Also remember to **keep the battery away from fire**.
- The Ni-MH battery packet of this equipment may explode if exposed to fire. **Do not place** the batteries near to a **source of heat**, as they can re-heat, produce spillage, catch fire, or explode
- **Do not wet** the batteries, as this could cause it to rust, and you could run the risk of fire, or an electric shock
- Do not leave the batteries in a car when it is hot outside, or under direct sunlight, near to the heating or near fire. The use of the batteries under these conditions can cause spillage, fire or explosions
- Both **to remove** the batteries, as well as **to connect them**, make sure that the meter is **switched off**
- If you remove the battery from the equipment, when you put it back in again, **make sure that you have replaced it as it was before**
- If you are using **metal tools** for the installation of the batteries, you must **isolate it**, as they could cause a shortcircuit.
- **Do not connect** the positive terminal to the negative terminal of a battery with a metal object, the battery could re-heat, emit hydrogen gas, undergo spillage, burn or explode.
- **Do not apply a soldering iron** directly on the battery
- **Do not put** the batteries into direct contact with plastic sheeting or PVC (not rigid). Do not apply organic solvents, gasoline, kerosene or paraffin, benzene, liquid detergents or paint to the batteries. If the batteries come into contact with these substances, they can break and thus undergo spillage.
- **Do not cover** the batteries with **materials that can generate static electricity,** as this could cause fire or an explosion
- **Do not try to disassemble, re-model or destroy the batteries**. This will produce spillage, fire or explosions. Sulphuric acid could also be spilt, which could cause the skin to burn.
- The battery contains diluted sulphuric acid, a very toxic substance. If the battery undergoes any spillage and any liquid is spilt on the skin or clothes, you must wash the area immediately with lots of water, as sulphuric acid can cause the skin to burn. If the battery liquid comes into contact with the eyes, immediately wash them with lots of water and visit your doctor.

APPENDIX 2.- Channels Plan

CCIR

CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz
E02	48,25	E05	175,25	S16	266,25	S29	367,25	21	471,25	34	575,25	47	679,25	60	783,25
E03	55,25	E06	182,25	S17	273,25	S30	375,25	22	479,25	35	583,25	48	687,25	61	791,25
E04	62,25	E07	189,25	S18	280,25	S31	383,25	23	487,25	36	591,25	49	695,25	62	799,25
S01	105,25	E08	196,25	S19	287,25	S32	391,25	24	495,25	37	599,25	50	703,25	63	807,25
S02	112,25	E09	203,25	S20	294,25	S33	399,25	25	503,25	38	607,25	51	711,25	64	815,25
S03	119,25	E10	210,25	S21	303,25	S34	407,25	26	511,25	39	615,25	52	719,25	65	823,25
S04	126,25	E11	217,25	S22	311,25	S35	415,25	27	519,25	40	623,25	53	727,25	66	831,25
S05	133,25	E12	224,25	S23	319,25	S36	423,25	28	527,25	41	631,25	54	735,25	67	839,25
S06	140,25	S11	231,25	S24	327,25	S37	431,25	29	535,25	42	639,25	55	743,25	68	847,25
S07	147,25	S12	238,25	S25	335,25	S38	439,25	30	543,25	43	647,25	56	751,25	69	855,25
S08	154,25	S13	245,25	S26	343,25	S39	447,25	31	551,25	44	655,25	57	759,25		
S09	161,25	S14	252,25	S27	351,25	S40	455,25	32	559,25	45	663,25	58	767,25		
S10	168,25	S15	259,25	S28	359,25	S41	463,25	33	567,25	46	671,25	59	775,25		

STDL

CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz
A	47,75	5	208	27	519,25	35	583,25	43	647,25	51	711,25	59	775,25	67	839,25
B	55,75	6	216	28	527,25	36	591,25	44	655,25	52	719,25	60	783,25	68	847,25
C1	60,5	21	471,25	29	535,25	37	599,25	45	663,25	53	727,25	61	791,25	69	855,25
C	63,75	22	479,25	30	543,25	38	607,25	46	671,25	54	735,25	62	799,25		
1	176	23	487,25	31	551,25	39	615,25	47	679,25	55	743,25	63	807,25		
2	184	24	495,25	32	559,25	40	523,25	48	687,25	56	751,25	64	815,25		
3	192	25	503,25	33	567,25	41	631,25	49	695,25	57	759,25	65	823,25		
4	200	26	511,25	34	575,25	42	639,25	50	703,25	58	767,25	66	831,25		

OIRT

CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz
R1	49,75	R6	175,25	S15	279,25	S28	383,25	23	487,25	36	591,25	49	695,25	62	799,25
R2	59,25	R7	183,25	S16	287,25	S29	391,25	24	495,25	37	599,25	50	703,25	63	807,25
R3	77,25	R8	191,25	S17	295,25	S30	399,25	25	503,25	38	607,25	51	711,25	64	815,25
R4	85,25	R9	199,25	S18	303,25	S31	407,25	26	511,25	39	615,25	52	719,25	65	823,25
R5	93,25	R10	207,25	S19	311,25	S32	415,25	27	519,25	40	623,25	53	727,25	66	831,25
S1	111,25	R11	215,25	S20	319,25	S33	423,25	28	527,25	51	631,25	54	735,25	67	839,25
S2	119,25	R12	223,25	S21	327,25	S34	431,25	29	535,25	42	639,25	55	743,25	68	847,25
S3	127,25	S9	231,25	S22	335,25	S35	439,25	30	543,25	43	647,25	56	751,25	69	855,25
S4	135,25	S10	239,25	S23	343,25	S36	447,25	31	551,25	44	655,25	57	759,25		
S5	143,25	S11	247,25	S24	351,25	S37	455,25	32	559,25	45	663,25	58	767,25		
S6	151,25	S12	255,25	S25	359,25	S38	463,25	33	567,25	46	671,25	59	775,25		
S7	159,25	S13	263,25	S26	367,25	21	471,25	34	575,25	47	679,25	60	783,25		
S8	167,25	S14	271,25	S27	375,25	22	479,25	35	583,25	48	687,25	61	791,25		

CCIR-IT

CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz
A	53,75	H1	217,25	27	519,25	35	583,25	43	647,25	51	711,25	59	775,25	67	839,25
B	62,25	H2	224,25	28	527,25	36	591,25	44	655,25	52	719,25	60	783,25	68	847,25
C	82,25	21	471,25	29	535,25	37	599,25	45	663,25	53	727,25	61	791,25	69	855,25
D	175,25	22	479,25	30	543,25	38	607,25	46	671,25	54	735,25	62	799,25		
E	183,75	23	487,25	31	551,25	39	615,25	47	679,25	55	743,25	63	807,25		
F	192,25	24	495,25	32	559,25	40	623,25	48	687,25	56	751,25	64	815,25		
G	201,25	25	503,25	33	567,25	41	631,25	49	695,25	57	759,25	65	823,25		
H	210,25	26	511,25	34	575,25	42	639,25	50	703,25	58	767,25	66	831,25		

DAB

CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz
05A	174,95	06C	185.35	08A	195.95	09C	206.35	10D	215.05	12A	223.95	13B	232.50		
05B	176,65	06D	187.05	08B	197.65	09D	208.05	11A	216.95	12N	224.10	13C	234.20		
05C	178.35	07A	188.90	08C	199.35	10A	209.95	11N	217.10	12B	225.65	13D	235.75		
05D	180.05	07B	190.65	08D	201.05	10N	210.10	11B	218.65	12C	227.35	13E	237.50		
06A	181.95	07C	192.30	09A	202.95	10B	211.65	11C	220.35	12D	229.05	13F	239.20		
06B	183.65	07D	194.05	09B	204.65	10C	213.35	11D	222.05	13A	230.80				

SIMULATOR 7637

CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz
0	7.50	2	22.60	4	7.50	6	22.60		
1	14.75	3	18	5	14.75	7	18		

SIMULATOR 4009

CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz
A	85	B	750						

The frequencies in this channel plan require the use of a universal LNB

ASTRA 19

ASTRA HL				ASTRA HH				ASTRA VL				ASTRA VH			
CH	**MHz**	**CH**	**MHz**	**CH**	**MHz**	**CH**	**MHz**	**CH**	**MHz**	**CH**	**MHz**	**CH**	**MHz**	**CH**	**MHz**
49	964	1	1464	65	1120	97	1744	50	979	2	1479	66	1139	98	1763
51	994	3	1494	67	1158	99	1782	52	1008	4	1509	68	1178	100	1802
53	1023	5	1523	69	1198	101	1822	54	1038	6	1538	70	1217	102	1841
55	1053	7	1553	71	1236	103	1860	56	1068	8	1568	72	1256	104	1880
57	1082	9	1582	73	1276	105	1915	58	1097	10	1597	74	1295	106	1922
59	1112	11	1612	75	1314	107	1945	60	1126	12	1627	76	1334	108	1952
61	1141	13	1641	77	1354	109	1974	62	1156	14	1656	78	1373	110	1981
63	1171	15	1671	79	1392	111	2004	64	1186	16	1686	80	1412	112	2010
33	1214	17	1714	81	1432	113	2033	34	1229	18	1729	82	1451	114	2040
35	1244	19	1744	83	1470	115	2063	36	1259	20	1759	84	1490	116	2070
37	1273	21	1773	85	1510	117	2092	38	1288	22	1788	86	1529	118	2099
39	1303	23	1803	87	1548	119	2122	40	1318	24	1818	88	1568	120	2128
41	1332	25	1832	89	1588			42	1347	26	1847	90	1607		
43	1362	27	1862	91	1626			44	1377	28	1877	92	1646		
45	1391	29	1891	93	1666			46	1406	30	1906	94	1685		
47	1421	31	1921	95	1704			48	1436	32	1936	96	1724		

HOTBIRD

HOTBIRD HL				HOTBIRD HH				HOTBIRD VL				HOTBIRD VH			
CH	**MHz**	**CH**	**MHz**	**CH**	**MHz**	**CH**	**MHz**	**CH**	**MHz**	**CH**	**MHz**	**CH**	**MHz**	**CH**	**MHz**
66	1139	98	1763	51	1147	83	1760	110	969	2	1492	50	1127	82	1741
68	1178	100	1802	53	1185	85	1799	112	1008	4	1533	52	1166	84	1780
70	1217	102	1841	55	1223	87	1837	114	1046	6	1572	54	1204	86	1818
72	1256	104	1880	57	1262	89	1876	116	1084	8	1613	56	1243	88L	1860
74	1295	106	1922	59	1300	91	1939	118	1123	8U	1631	58	1281	88U	1884
76	1334	108	1952	61	1338	93	1977	120	1161	10	1658	60	1319	90	1920
78	1373	110	1981	63	1377	95	2016	122	1199	12	1696	62	1358	92	1958
80	1412	112	2010	65	1415	97	2054	124	1242	12U	1714	64	1396	94	1997
82	1451	114	2040	67	1454	99	2092	126	1284	14	1739	66	1434	96	2035
84	1490	116	2070	69	1492	101	2131	128L	1310	14U	1753	68	1473	98	2073
86	1529	118	2099	71	1530			128	1329	16	1781	70	1511	100	2113
88	1568	120	2128	73	1569			130	1364	154	1835	72	1549		
90	1607			75	1607			130U	1381	156	1873	74	1588		
92	1646			77	1645			132L	1393	158	1912	76	1626		
94	1685			79	1684			132	1411			78	1665		
96	1724			81	1722			134	1450			80	1703		

HISPASAT

HISPASAT HL				HISPASAT HH				HISPASAT VL				HISPASAT VH			
CH	**MHz**	**CH**	**MHz**	**CH**	**MHz**	**CH**	**MHz**	**CH**	**MHz**	**CH**	**MHz**	**CH**	**MHz**	**CH**	**MHz**
85A	1713	87D	1865	41	1131	62	1572	81A	1759	84D	1917	47	1131	91	1703
85B	1721	88A	1895	42	1171	70A	1939	81B	1785	84E	1923	48	1171	92	1780
85C	1729	88B	1904	43	1211	70B	1946	82A	1811	84F	1932	77	1206	93	1856
85D	1736	88C	1910	44	1251	71	1991	82B	1817			49	1211	67A	2016
85E	1742	88D	1925	45	1291	73A	2056	82C	1823			50	1251	67B	2026
85F	1748			46	1331	73B	2063	82D	1830			51	1291	67C	2032
85G	1753			53A	1356	73C	2069	82E	1837			80A	1313	67D	2038
85H	1760			53B	1358	73D	2075	82F	1843			80B	1324	67E	2045
86A	1771			55	1452	73E	2081	83A	1851			52	1331	68	2071
86B	1776			56A	1479	73F	2087	83B	1858			80C	1333		
86C	1783			97A	1485			83C	1864			57	1372		
86D	1789			56B	1488			83D	1870			58	1412		
86E	1796			97B	1495			83E	1876			59	1452		
86F	1801			56C	1496			83F	1882			60	1492		
87A	1813			98A	1521			84A	1895			89	1549		
87B	1818			98B	1531			84B	1904			64	1572		
87C	1833			61	1532			84C	1911			90	1626		

ASTRA 28º

CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz
42	979	50	1097	1	1120	8	1256	15	1392	22	1529	29	1666	36	1802
43	994	51	1112	2	1139	9	1276	16	1412	23	1548	30	1685	37	1822
45	1023	52	1126	3	1158	10	1295	17	1432	24	1568	31	1704	38	1841
46	1038	53	1141	4	1178	11	1314	18	1451	25	1588	32	1724	39	1860
47	1053	54	1156	5	1198	12	1334	19	1470	26	1607	33	1744	40	1880
48	1068	55	1171	6	1217	13	1354	20	1490	27	1626	34	1763		
49	1082	56	1186	7	1236	14	1373	21	1510	28	1646	35	1782		

NILESAT

CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz
2	1147	4	1185	6	1223	8	1262	10	1300	14	1377	17	1434		
3	1166	5	1204	7	1243	9	1281	13	1358	16	1415				

ARABSAT

CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz
2	1147	7	1243	11	1319	13	1358	16A	1410	19	1473				
4	1185	8	1262	12	1338	15	1396	16B	1426						

EUROBIRD

CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz
C1	1472	D1S	1719	D6S	1815	D11S	1912	F1SC	1930	F1SG	1966	F4SB	2002	F4SF	2038
C5A	1640	D2S	1738	D7S	1835	D12S	1931	F1SD	1939	F2SC	1967	F3SA	2007	F3SB	2043
C6A	1640	D3S	1758	D8S	1854	F1SA	1912	F2SB	1946	F2SD	1971	F4SC	2011	F4SG	2047
C5B	1676	D4S	1777	D9S	1873	F1SB	1921	F1SE	1948	F1SH	1974	F4SD	2020	F4SH	2056
C6B	1676	D5S	1796	D10S	1892	F2SA	1929	F1SF	1957	F4SA	1993	F4SE	2029		

EURASIASAT

CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz
2	1134	7A	1230	9E	1287	16D	1428	24D	1936	28G	2021	29D	2052	31F	2102
3A	1152	7B	1239	10A	1292	21	1533	23E	1938	29A	2029	30F	2057	31G	2106
3B	1170	7C	1246	10B	1305	23A	1912	24E	1940	29B	2033	30G	2064	34A	2115
3C	1179	7D	1252	10C	1312	24A	1916	28A	1990	30A	2033	31A	2077	34B	2119
4A	1182	7E	1258	13A	1354	23B	1918	28B	1996	29C	2036	32	2078	34C	2122
4B	1200	9A	1267	13B	1373	24B	1924	28C	2001	30B	2038	31B	2085	34D	2127
5	1204	9B	1274	16A	1402	23C	1927	28D	2005	30C	2041	31C	2089	34E	2132
6A	1210	9C	1278	16B	1406	24C	1932	28E	2010	30D	2046	31D	2093	34F	2137
6B	1219	9D	1282	16C	1410	23D	1933	28F	2014	30E	2050	31E	2098		

TURKSAT

CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz
4A	1203	5B	1269	6UB	1317	15B	1389	8H	1420	1E	1750	2D	1839	3B	1902
4B	1206	5C	1275	14B	1335	15C	1392	16A	1425	1F	1761	2E	1849	3C	1914
4C	1213	13A	1276	7	1346	8C	1393	16B	1445	9	1769	10	1857	3D	1923
4D	1218	13B	1297	15L	1373	8D	1396	1A	1715	1G	1771	2F	1858	3E	1932
4E	1225	6	1298	8A	1379	8E	1402	1B	1733	2A	1806	2G	1867	3F	1941
4F	1235	6UA	1313	8B	1385	8F	1409	1C	1739	2B	1810	2H	1873		
5A	1256	14A	1316	15A	1386	8G	1414	1D	1745	2C	1815	3A	1894		

AMAZONAS

CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz
11	1498	13	1376	4A	1306	6	1184	17	1119	9	1010	21	1225		
1	1489	3	1367	15	1254	16	1180	8	1062	19	997	4B	1492		
2	1428	14	1315	5A	1245	7	1123	18	1058	10	970	5B	1532		

SIRIUS 5º

CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz
1A	1121	6	1223	13	1358	19	1473	31	1703	39B	1865	4C	2034	11C	2091
1B	1139	7	1243	14	1377	20	1492	32	1722	3B	1990	10	2037	5D	2097
2	1147	8	1262	15	1396	21	1511	35	1780	3C	2000	4D	2039		
3A	1166	9	1281	16	1415	27	1626	37	1818	3D	2008	11B	2072		
4A	1185	11A	1319	17	1434	28	1645	38	1837	3E	2017	5B	2074		
5A	1204	12	1338	18	1454	29	1665	39A	1849	4B	2029	5C	2083		

THOR 1º W

CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz
1	1466	5	1528	8	1575	13	1653	2B	1147	24	1569	31	1703	39	1856
2A	1479	6A	1543	9	1591	14	1671	6B	1223	27	1626	32	1722	40	1876
3	1497	7	1559	10	1607	15	1684	18	1454	28	1645	36	1799		

I.F. SIMULATOR 4008(1)

CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz
0123A	960	67A_VL	960	67A_HL	990	67A_VH	960	67A_HH	990
0123B	1550	67B_VL	1550	67B_HL	1540	67B_VH	1550	67B_HH	1540
0123C	2140	67C_VL	2140	67C_HL	2110	67C_VH	2140	67C_HH	2110

HL ⟹ Horizontal pol. / Low band
VL ⟹ Vertical pol. / Low band
HH ⟹ Horizontal pol. / High band
VH ⟹ Vertical pol. / High band

(1) Values for the IF simulator 4008
0123 ⟹ Any of the four positions 0, 1, 2 or 3
67 ⟹ Any of the two positions 6 or 7
ABC ⟹ Values of the three generated frequencies

SIMULATOR 4009

CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz
C	1000	C_VH	1000	C_VL	1000	B_VH	2150	B_VL	2150
D	2150	C_HH	1000	C_HL	1000	B_HH	2150	B_HL	2150

DAB

CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz
L1	1452.8	L7	1463.2	L13	1473.7	L19	1484.2	LA	1452.9	LG	1463.2	LM	1473.5	LS	1485.4
L2	1454.5	L8	1465	L14	1475.4	L20	1485.9	LB	1454.6	LH	1464.9	LN	1476.9	LT	1487.2
L3	1456.3	L9	1466.7	L15	1477.2	L21	1487.9	LC	1456.3	LI	1466.6	LO	1478.6	LU	1488.9
L4	1458	L10	1468.5	L16	1478.9	L22	1489.4	LD	1458	LJ	1468.3	LP	1480.3	LV	1490.6
L5	1459.7	L11	1470.2	L17	1480.7	L23	1491.1	LE	1459.8	LK	1470	LQ	1482		
L6	1461.5	L12	1472	L18	1482.4			LF	1461.5	LL	1471.7	LR	1483.7		

GUARANTEE

Televés S.A. offers a one year guarantee, beginning from the date of purchase for countries in the EEC.

For the batteries and due to the characteristics of this article, the guarantee period is limited to six months.

For countries that are not part of the EEC, the legal guarantee that is in force at the time of purchase is applied.

Keep the purchase invoice to determine this date.

During the guarantee period, **Televés S.A.** becomes position of the failures produced by defect of the material or manufacture.

The harm produced by improper usage, wear and tear, manipulation by a third party, catastrophes or any other cause beyond the control of **Televés S.A.** is not included in the guarantee.

TECHNICAL ASSISTANCE

At the end of the manual, there is a complete list of our closest Technical Assistance points, their telephone numbers and emails which can be used for any request or question.

REPAIR SERVICE

1º- In order to facilitate the identification of the failure, use the following table:

Code	Description
100	Battery life less than 50 % of that stipulated, after a complete charging process
200	Screen has little brightness or is switched off
300	The meter does not switch on
400	It does not work in TV mode and the SCART configuration is correct
500	Other problems. Please indicate

2º- Contact Televés through the Technical Assistance Service (consult last page of manual).

3º- If it is the advice of our Technical Assistance Service to send the meter for revision, Televés will organise the collection and delivery of the meter from and to the address that the Client indicates free of charge.

4º- You simply have to pack and identify the bulk. We recommend that you return the product in its original packaging for two reasons:

a) Only in this case are we responsible for any damage that the meter may undergo during the transportation to Televés SAT.

b) If the box already disposes of a label, pack the equipment so that this can be seen and read, if this is not possible, cut the label off and stick it back onto the packaging.

5º- If the packaging is not sufficiently good and as a result, any damage is caused, the sum will be invoiced having received the Client's approval, or the product will be returned to the client, with Televés covering the return costs.

Label to identify bulk for delivery to the Technical Assistance points.

A (receptor / receiver)

Nombre de la compañía / Company name

TELEVES SAT MEDIDORES

Dirección de entrega / Delivery address

C/ Volta do Castro S/N
Santiago de Compostela
A CORUÑA

Código postal / Postal code	Pais / Country
15706	**ESPAÑA**
Persona de contacto / Contact person	Telef.
Gestión Calidad	**981 52 22 00**

Indique motivo / Indicate reason / Motif du retour

☐	Duración batería Battery life Durée batterie
☐	Pantalla con poco brillo o apagada Screen with little brightness or switched off Ecran avec point blanc ou clignotant
☐	No enciende el medidor The meter does not switch on Pas d'allumage de l'appareil
☐	No funciona en modo TV y la configuración del SCART es correcta It does not work in TV mode and the SCART configuration is correct Ne fonctione pas en mode TV et la configuration de la peritel est correcte
☐	Otros. Indicar cual: Other problems. Please indicate: Autres. Indiquez lequel:

Televés

DECLARACIÓN DE CONFORMIDAD
DECLARAÇÃO DE CONFORMIDADE
DECLARATION DE CONFORMITE
DECLARATION OF CONFORMITY

Fabricante / *Fabricante / Fabricant / Manufacturer*:	**Televés S.A.**
Dirección/ *Direção / Adresse / Address*:	**Rúa B. Conxo, 17** **15706 Santiago de Compostela** **SPAIN**
NIF / *VAT*:	**A-15010176**

Declara bajo su exclusiva responsabilidad la conformidad del producto:
Declara sob sua exclusiva responsabilidade a conformidade do produto:
Declare, sous notre responsabilité, la conformité du produit:
Declare under our own responsibility the conformity of the product:

Referencia/ *Referencia / Référence / Reference*:	**5922**
Descripción / Descrição / *Description / Description*:	**Multimetter FSM 450**
Marca / *Marca / Marque / Mark*:	**Televés**

Con los requerimientos de la Directiva de baja tensión 73 / 23 / CEE y Directiva EMC 89 / 336 / CEE, modificadas por la Directiva 93 / 68 / CEE, para cuya evaluación se han utilizado las siguientes normas:

Com as especificações da Directiva da baixa tensão 73 / 23 / CEE e Directiva EMC 89 / 336 / CEE, modificadas pela Directiva 93 / 68 / CEE, para cuja aprovação se aplicou as seguintes normas:

Avec les spécifications des Directives 73/ 23 / CEE et 89 / 336 / CEE, modifiées par la directive 93 / 68 / CEE, pour l'évaluation on a appliqué les normes:

With the Low Voltage Directive 73 / 23 / EEC and the EMC Directive 89 / 336 / EEC as last amended by Directive 93 / 68 / EEC requirements, for the evaluation regarding the Directive, the following standards were applied:

EN 61010-1:1993 + A2:1995
EN 61326:1997 + A1:1998

Santiago de Compostela, 19/10/2006

CE

José L. Fernandez Carnero
Technical director

Red Comercial Nacional

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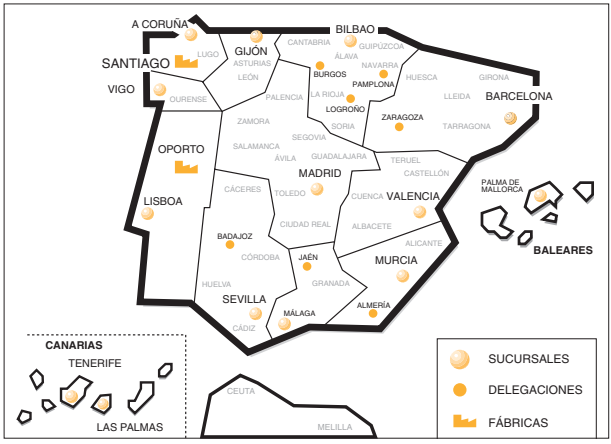

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Field Strength Meter

Multimetter FSM 450

User Manual

Televés

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